THE WAR IN EGYPT.

Over the actual condition of affairs in Egypt, as regards the position and intention of Arabi Pasha, hangs a cloud of impenetrable darkness, and although every paper receives articles almost daily "from its own correspondent" on board one of Her Majesty's ships, no paper obtains letters direct from the camp of Arabi. His words and actions would undoubtedly be of interest to the public, yet they are not chronicled.

The accompanying map gives a general idea of the lower portion of Egypt, and the location of the great canal and railroad lines. The main interest of the civilized world gathers around the canal, and the doubt and anxiety concerning Arabi's power and intention in regard to it give the whole subject an amount of attention it would not otherwise receive.

THE DEAN STEAM PUMP WORKS.

From a late issue of the Indianapolis *Herald* we clip the following:

Indianapolis is fast assuming an important position among the manufacturing cities of the West. Her rolling mills, tile works, the Atlas engine works, are second to none, and supply the trade throughout the entire country. The steam pump works of the Dean Brothers, is another important manufactory that will well repay a visit. They have been established in Indianapolis for 12 years, having come to Indiana in 1870, from central New York. From an ordinary beginning, their business has increased until they now employ over 100 men, and send their pumps to every part of the United States. This growth has necessitated the building of new shops and office, which are a revelation to builders and manufacturers in this part of the country. They have combined with convenience, space and excellence, an artistic effect that is extremely attractive. The latter is particularly fine, and may be taken as an example of what æstheticism, in the best sense of that abused word, will do toward converting a place of business into a beautiful structure that time will only render more picturesque. The shops extend along Madison avenue and Ray street, and are 330 × 50 ft. They are well lighted and ventilated, a track running the entire length for convenience in moving machines. There is an office for the superintendent of the shops, with speaking tubes connecting it with the main office. The buildings are of brick, with trimmings of black brick and cut stone.

The main office stands at the corner of Ray street and Madison avenue. This is in the Elizabethian style, with tile roof and half timbered work under the cornices. The windows on the first floor are very artistic, the lower sash being of New Albany plate glass, while the upper are stained glass from Utica, N. Y., the design being very original and the color brilliant though sufficiently subdued. The wood-work is of oil-finished black walnut, the carving has been done by hand. The vestibule into which the visitor is first ushered, is paved with black, red and cream-colored tile. A handsome counter of black walnut supplied with drawers and shelves, extends across the vestibule, separating it from the main office, which is entered by a pretty gate of black walnut, also carved. The main office is lavishly supplied with handsome desks and chairs. The heating is done by steam, but there is also in this apartment a grate with a beautiful mantel and hearth of white, brown and cream-colored tile. A large fire-proof vault for papers and drawings, a washroom supplied with hot and cold water, and a private office which is to be elegantly fitted up, open out of the main office. The room above is finished in white pine. This is well lighted and is used as a draughting room and mailing department, from which large quantities of circulars and lithographs are sent daily. The windows of this room are also noticeable—the lower portion being a single pane of plate-glass, while the upper contains many small panes. The effect is exceedingly quaint and pretty.

The handsome landscape painting ornamenting the door of the large safe in the office, is the work of Mary H. Krout, of Crawfordsville. The deft manner in which the brush has been handled demonstrates that the author of "Little Brown Hands" can paint with the brush as well as with the pen, and that she is an artist as well as an author.

All the draughting and casting is done under their own supervision, drawings, patterns and castings being all made in their own shops. There is nothing that will secure such excellence as personal attention to one's own business, whatever it may be. No amount of money will secure the same carefulness and dispatch as is secured by the man who looks himself to see that his orders are obeyed. This probably explains the rapid growth of their trade, since it accounts for the excellence of their work.

Besides many other important commissions, they have this year supplied Edmore, Michigan, with water-works machinery, the Du Pont paper mills, of Louisville, with two pumps capable of delivering one million gallons in twenty-four hours, a large pump for the Chattanooga iron works, and are now making some fine machinery for the new steel works of this city, and have received an order from Peoria to supply a distillery with a pump to cost four thousand dollars. A pump of their manufacture is used in the Sibley College of Mechanical Arts, Cornell University, for illustration and experiment.

There is no reason why men should reserve all their choicest possessions for their homes. Two-thirds of a business man's time, at least, is spent in his office or shop. Dust, confusion, bad air, spittoons, ink-stained desks and dilapidated chairs generally render these places cheerless and dreary in the extreme. Such things can not fail to have a dire effect upon the health and spirits, and consequently upon the minds and energies. Surroundings that are pleasant and comfortable may therefore be regarded as the best of all good investments, and the example set by this prosperous firm is well worthy of imitation, not only here in Indianapolis, but wherever men work and build.

RAILWAY TRAVEL IN EUROPE AND AMERICA.

Mr. Robert S. Minot, of this city, has prepared, and Messrs. A. Williams & Co., have published, a pamphlet entitled "Railway Travel in Europe and America," which is crowded with facts interesting both to those who are travelers and to those who are not. His primary postulate is that the progress of civilization is more or less co-extensive with the progress of means of communication and transportation, and he cites the railway and telegraphic development of eastern and western Europe and that of this country to support this proposition. Travel, he says, is a sort of education; hence those who are eager for self-improvement, and race-improvement, must desire that railroads and steamboats should be brought to such perfection that the Atlantic may be crossed in a week for half the present fare, that New York and San Francisco may be within three days of each other, and that the journey around the world may be made in a month or six weeks, all of which may be realized within the present century. It has been proved that the average traveler may journey millions of miles on land and sea with perfect safety, that a new-born babe must travel incessantly at the rate of forty miles an hour for about a century in order to run the average risk of being killed by a railroad, and for about twenty-five years to sustain any injury whatever.

In a comparison of the methods of railway travel followed here, where baggage is not weighed, and in Europe, where it is weighed, it is said that in this country not more than ten minutes is wasted in preliminaries, while in Europe at least half an hour must be allowed for them; that the waiting-rooms on this side the Atlantic are warm and stuffy, on the other side cold and stuffy, while the cars are subject to the same criticism. The foreign first-class railway carriage is equal in appearance to the best American car; it is lighter in proportion to its length, and therefore on good roads it runs with a smoother motion; it is better stuffed, and is provided with a head support. Because of these advantages, travel in it is much less tiresome than that on American railways; but this is offset by the passenger being locked in his compartment; by the lack in cold weather of artificial heat, and by the absence of all toilet appliances. As for American palace cars, for long journeys at least, there are no superiors. Many second-class foreign carriages are quite as comfortable as are those of the first-class, but those of the third-class are mere cattle vans with wooden seats for the human bipeds who may occupy them. On foreign trains the usual fares are four, three and two cents per mile, according to class, with extra charges for express trains, fees to officials and payments for above 50 pounds of baggage, making first-class European travel more costly by from one to two cents per mile than that in palace cars in the United States east of the Mississippi River. In Europe generally, and in France especially, such stops are made by long distance trains, whether they are or are not on time, that all their passengers have ample opportunity to eat with comfort and security to the full satisfaction of their hunger.

MAP OF LOWER EGYPT.

For number of trains and for speed, England leads the world. From London to Grantham, 105¼ miles, the running time is 2 hours 3 minutes, nearly 52 miles an hour; from London to Bedford, 50 miles, the run is made in 54 minutes, or at the rate of 55½ miles an hour. The new Chicago lightning express averages 36.75 miles per hour; that between New York and Boston maintains a speed of 38.38 miles per hour. The fastest train in France—that from Paris to Bordeaux—runs about 360 miles in 9 hours. The chief Brussels expresses run about 29 miles an hour in France and 38 miles an hour in Belgium. The fastest train in Germany—the Paris train from Berlin and Cologne—runs at the rate of 40 miles an hour until it reaches French territory, when the rate drops to 27 miles an hour. Austrian trains run slowly, but charges for them are low; Holland and Belgium have high speed and low fares; Italy and Spain show, considering their mountainous territories, fair speed; Russia, Portugal and Switzerland make fair showings. Railway civilization in America holds a westerly course. In the Middle States the best speeds are shown; New England is a very good second; in the Western States no notable speed is to be found; in the Northwestern and Southwestern States and in the Far West speeds continue to diminish until the confines of civilization are reached. The Wisconsin Central Railroad carries off the palm in the slow race, having a record of 351 miles in 52 hours 20 minutes—6¾ miles per hour. The effects of heavy grades and curves is well shown by travel on the Boston and Albany Railroad; in the Berkshire Mountains, where the maximum grade is more than 80 feet to the mile, a train of six cars and two locomotives makes on up grades from 21½ to 30 miles an hour; on down grades 44 or 45 miles an hour. On the Old Colony Railway, on a local express to Middleborough, a train of ten cars, with one locomotive, averages in clear running speed 40 miles an hour. On 140 European routes, the average speed of the fastest 140 trips exceeds that of the slowest 140 trips by 46 per cent.; in America such excess is only 25 per cent., and it is almost entirely due to the omission of stops by express trains. In Europe the nominal differentiation in fares is 114 per cent.; in America it is zero. The conclusion is that one important reason for the absence of great speeds in America is this lack of differentiation of charges; if three rates of fare were established the postal American express trains would run 10 per cent. faster, and the slowest 10 per cent. slower.

In great through travel the average speed in Europe is 23.12, in the United States 24.31 miles per hour; the average fare in Europe, 2.74 cents permile, is raised to 3.02 cents adversely to great through travel, while in the United States the average, 3.79 cents per mile, is lowered to 2.88 cents in favor of such travel, a practical illustration of the blessing of union and concord in a great country. In the advance of civilization the highest speeds are concomitant with the lowest fares, and this law will be brought forward more prominently by considering that the true estimate of cheap fares is the distance that the laboring man can travel on a day's wages. In France a workman gets 60 cents a day, which would carry him less than 30 miles third-class; in Italy and Spain perhaps 20 or 30 cents a day, on which he could travel only 10 or 15 miles. In the United States the workman can travel 40 or 50 miles on a day's wages; in New England and the Middle States, 60; in the far West about 25; in the South possibly still less. The present American system of railroad travel is based on two grounds, that it is much easier to run trains with one class of carriages than with three classes, and that all the people are in theory at least, socially equal. The European system is, however, the truly democratic one, for how can it be said that Americans are pecuniarly free and equal when the poor man must pay three cents to go a mile by rail while Vanderbilt and Jay Gould ride free? Differentiation of railway fares rests only on the difference of means; uniform rates mean that the rich may go freely where they please to seek better fortune, while the poor must remain where they are, no matter how unfortunate they may be. There should also be a reduction in the weight of cars; it is said that the American passenger train is usually over twice as heavy as the English train for an equal number of passengers. American railroads are apparently safe enough for use upon them of lighter vehicles; if they are not, safety should be secured in some way other than by compelling each traveler to carry about with him a ton or more of wood and iron.

In England, some of the principal trains are run thus: London to Edinburgh, 400 miles; fastest time, 9 hours; slowest time, 14 hours 25 minutes. London to Liverpool, 120 miles; fastest, 4 hours 50 minutes, slowest, 8 hours 20 minutes. London to Leeds, about 200 miles; fastest, 4 hours; slowest, 9 hours 25 minutes. London to Manchester, 190 miles; fastest, 4 hours 40 minutes; slowest, 6 hours, 50 minutes. London to Bristol, 118 miles; fastest, 2 hours 36 minutes; slowest, 4 hours 40 minutes. London to Brighton, 50 miles; fastest, 1 hour 10 minutes; slowest, 2 hours 30 minutes. In France—Paris to Bordeaux, 363½ miles; fastest train, 9 hours 7 minutes; slowest, 16 hours 30 minutes. Paris to Marseilles, 535½ miles; fastest, 14 hours 42 minutes; slowest, 29 hours 25 minutes. Paris to Strasbourg, 311 miles; fastest, 10 hours 27 minutes; slowest, 16 hours 37 minutes. Paris to Cologne, 308 miles; fastest, 11 hours 10 minutes; slowest, 17 hours, 5 minutes. Paris to Calais, 184½ miles; fastest, 5 hours; slowest, 9 hours 35 minutes. In North Germany, Berlin via Magdeburg, to Cologne, 362½ miles; fastest, 9 hours; slowest, 19 hours 5 minutes; Berlin to Bremen, 211 miles; fastest, 6 hours 35 minutes; slowest, 9 hours 23 minutes; Berlin to Hamburg, 177½ miles; fastest, 4 hours 45 minutes; slowest, 8 hours 50 minutes. In South Germany, Dresden to Prague, 119 miles; fastest, 4 hours 38 minutes; slowest, 7 hours 15 minutes; Dresden to Munich, 300 miles; fastest, 14 hours 51 minutes; slowest, 17 hours. In Austria—Vienna to Munich, 266 miles; fastest, 9 hours 45 minutes; slowest, 17 hours 55 minutes; Vienna to Prague, 217½ miles; fastest, 7 hours 20 minutes; slowest, 11 hours 56 minutes. In Russia—St. Petersburg to Moscow, 401 miles; fastest, 22 hours 30 minutes; slowest, 28 hours 10 minutes; Warsaw to Moscow, 810 miles; fastest, 38 hours 24 minutes; slowest, 49 hours 18 minutes; Warsaw to Odessa, 842 miles; fastest, 40 hours 32 minutes; slowest, 49 hours 25 minutes. In Italy—Turin to Brindisi, 681 miles; fastest, 27 hours; slowest, 27 hours 57 minutes; Florence to Rome, 195½ miles; fastest, 7 hours 50 minutes; slowest, 13 hours 10 minutes.

The following are some of the distances and speeds on this side of the Atlantic: Boston to New York, 226 miles; fastest, 6 hours 33 minutes; slowest, 9 hours 43 minutes. Boston to Montreal, 338 miles; fastest, 11 hours 35 minutes; slowest, 14 hours 50 minutes. Boston to St. John, N. B., 450 miles; fastest, 22 hours 40 minutes; slowest, 28 hours 5 minutes. New York to Chicago, 902 miles; fastest, 29 hours 10 minutes; slowest, 36 hours 55 minutes. New York to Cincinnati, 757 miles; fastest, 24 hours 30 minutes; slowest, 27 hours. New York to St. Louis, 1,065 miles; fastest, 35 hours 3 minutes; slowest, 38 hours 52 minutes. New York to New Orleans, 1,395 miles; fastest, 54 hours 41 minutes; slowest, 60 hours 44 minutes. St. Louis to New Orleans, 700 miles; fastest, 34 hours 34 minutes; slowest, 35 hours 21 minutes. St. Louis to Galveston, 870 miles; fastest, 46 hours 17 minutes; slowest, 50 hours 23 minutes.—*Boston Journal.*

ELECTRIC LIGHTING IN THE CITY.

A report to the Streets Committee of the Sewers Commissioners has recently been presented by Mr. William Haywood upon the prolonged experiment of street electric lighting, which was commenced in April, 1881. This experiment was undertaken on the action of the Streets Committee, who were requested in March, 1880, to consider and report upon the adoption of an improved mode of lighting the city streets. The Committee considered it advisable that a trial should be given to the electric light, and in this view they were sustained by the Bridge House Estates Committee, who were also desirous of trying the experiment. These two bodies co-operating, decided upon lighting certain of the main thoroughfares, including London, Southwark and Blackfriars bridges, and it was arranged that while the Sewers Commissioners should undertake the management of the trial, the Bridge House Estates Committee should pay the cost of lighting the bridges above mentioned. Acting upon this determination, tenders were applied for in the autumn of 1880, and were received from six different contractors. The area to be lighted was divided into three groups, and the tenders of three contractors were accepted. The main conditions of the experiment were, that it should extend over twelve months; that the lighting should continue each day from sunset to sunrise, and that no gas should be used except as a substitute during the period of trial. The first district included a length of streets of 1648 yds., and an area of 39,887 square yds. It comprised Blackfriars Bridge; New Bridge street; Ludgate Circus; Ludgate Hill; the north side of St. Paul's Churchyard; and Cheapside from its western end to King-street.

The second district, 1703 yds. in street length and 27,394 square yds., comprised Southwark Bridge; Queen Victoria street; Queen street, between Queen Victoria street and Upper Thames street; and Queen-street-place.

The third district, 1,521 yards in length and 33,321 square yards in area, included London Bridge; Queen street, between Queen Victoria street and Cheapside; Cheapside, between King street and the Poultry; King street, Guildhall Yard; the Poultry; Mansion House street; the open space in front of the Royal Exchange; King William street, and Adelaide street.

In October, 1880, the lighting of these three districts was allotted as follows: To the Anglo-American (Brush) Company, District No. 1, at a cost of £1,410; to the Electric and Magnetic Company (Jablochkoff system), District No. 2, for £2,930; to Messrs. Siemens Brothers, District No. 3, for £3,729. The second named company failed to carry out their contract, which was assigned to the Electric Light and Power Company, but so much delay occurred before this company completed their work that the twelve months of trial will not be completed before April next, so that the present report deals almost exclusively with Districts Nos. 1 and 3. Dividing the amount of each tender into permanent works and cost of lighting, the three accepted tenders stood as follows:

	For works.	For lighting.	Total.
	£	£	£
District No. 1, Brush	750	660	1410
" No. 2, Electric Light and Power Company	1470	1460	2930
District No. 3, Siemens	1450	2270	3720
	3670	4390	8060

The quantity of light given for each district did not vary in anything like the proportion of the cost, as will be seen from the accompanying table:

	Number of lamps.	Nominal candle power per camp.	Total nominal power.
District No. 1	33	1000	33,000
" No. 2	32	1000	32,000
" No. 3	6 large.	5000	30,000
	28 small.	300	8,400
	99		103,400

These lights replaced 156, 157 and 139 gas lamps respectively, each giving 14 candles, and representing a total illuminating power of 6,328 candles, so that the electric light was about 16.3 times greater, while the total cost for gas during the year would have been £2,000, as compared with the £4,390 for the electric light: rather more than twice the cost of gas for sixteen times the quantity of light. In making this comparison, however, it is only fair to point out the great difference in the prices charged by the various contractors; thus for the three districts, the relative cost of gas and electricity stood as follows:

	Cost of Gas.	Cost of Electric Light.
	£	£
District No. 1, Brush	690	660
" " 2, Lontin	700	1,460
" " 3, Siemens	612	2,270

The Brush lamps gave approximately 15 times as much light as the standard gas lamps; Lontin gave 14½ times, and Siemens 20 times as much light. The area thus illuminated was in all 100,512 square yards, or 1,015 square yards on an average for each of the 99 lamps; the area lighted by gas averaged 222 square yards per lamp. It is not necessary to describe here the different modes by which each company carried out its work, for this we may refer the reader to *Engineering*, vol. xxxi., page 335. But we may mention that the Brush Company and the Electric Light and Power Generator Company were very favorably situated, inasmuch as they were enabled to feed the lamps from their factories, while Messrs. Siemens were obliged to establish a special power station. Considering that each of the contracting companies furnished nearly the same quantity of light, it is not easy to understand the wide differences that existed in the prices charged. The most interesting part of Mr. Haywood's report is that referring to the defects observed during the year. For the reason above stated, only Districts Numbers 1 and 3—Brush and Siemens—are reported on, the results in District No. 2 being incomplete. In District No. 1 there were 33 lamps in operation, each burning normally through the year 4,300 hours, or 141,900 hours in all. There was a total of 660 failures reported, the aggregate extinction of the light having equalled 3,142 hours of a single lamp, or 2.21 per cent. of the entire years' lighting. In District No. 3 (Siemens) there were 34 lamps burning for a total of 146,200 hours during the year. In this district the total number of failures was 320, equal to an aggregate of 837 lamp-hours, or .57 per cent. of the total lighting.

On analyzing these stoppages we shall find that considerable deductions must be made from each, before estimating the practical value of the systems for street lighting. The Brush lamps were started on the 29th of April, and on the 2d of May it was found that the insulation of the main conductor was defective, and a new cable had to be substituted; this caused a delay of seventeen days, on nine of which the system was not in operation, and a total loss of 2630 lamp-hours occurred. In the third district also, five days after starting, the conducting cable was damaged by barges passing under London Bridge, and a total of 340 hours was lost in the illumination. It is clear that the extinction from these causes have to be eliminated, as they were due to no defect in the systems,

but to imperfect installation. There was, therefore, during the year, apart from these accidents, a loss of 512 hours in the Brush district, and of 492 in the Siemens, showing a slight advantage to the latter system, though for all practical purposes both were identical. It will be interesting to classify roughly the reported causes and extent of these extinctions:

	Brush. h. m.	Siemens. h. m.
Accidents to driving machinery	209.30	128.0
Through malice	.23	0.0
Defective carbons	6.10	214.0
" or dirty lamp	112.7	144.0
Carelessness of attendants	26.13	0.0
Broken lamp-post	103.0	0.0
Carbons burnt out	18.48	5.0
Short circuiting	0.0	7.29

The number of lamps affected by the delays as explained by the companies are as follows, exclusive of the accidents to conductors already referred to:

	Brush.	Siemens.
Defective machinery	180	126
" carbons	24	124
Miscellaneous	02	36

The most striking feature in the above statement is the difference in the delays to the two systems caused by the carbons. In the Brush only 24 instances were recorded, involving a little more than six hours' delay on the year, which is practically nothing. On the other hand, the Siemens lamps were interferred with 124 times, and for 214 lamp hours, or more than 90 times as much as the Brush. This is simply a question of detail, and proves what has always been claimed for the Brush system—the excellence of its carbons. It proves also that so far as carbons are concerned there is no difficulty in the solution of the problem of efficient street lighting by electricity. On the other hand, in the delays arising from breakdown of machinery, motors, or generators, only 128 hours' delay occurred in the Siemens system as compared with 209 in the Brush, and it is evident that while accidents are unavoidable, if proper precaution be taken in duplicating machinery, the delays arising from this cause can be reduced to such an extent as to be practically inappreciable. Still more striking is the difference in the trouble caused by carelessness, for while Brush lost 26 hours from this cause, Siemens lost no time at all. Of one of the other causes, the broken lamp-post which resulted in 103 hours' delay in No. 1 district, it is clear that this must be classed among the unavoidable contingencies, although it must be borne in mind that the extinction of an electric lamp is a far more important matter than that of a gas lamp lighting only one-fifth the area.

It will be seen, we think, that the comparison made between the two systems after this extended trial is very satisfactory, because it proves that the chief proportion of the causes of extinction are easily to be avoided, excepting perhaps as regards the lamp mechanism which will probably be simplified as time goes on. It will be noticed that the delays from this cause were nearly equal in both systems, but while the majority in the Brush system arose from defective mechanism, nearly all the Siemens are reported as "Lamps required cleaning."

It may be mentioned as an interesting fact that the total number of gas lamps in the city of London is 3,225, and the number of badly defective lights noticed during 1881 was 2,509, a very large proportion, but which is neither so noticeable nor so important as a much smaller amount of defectiveness in the electric lights, on account, as above mentioned, of their greater power and smaller number.

In a report of the Streets Committee to the Commissioners of Sewers, some detailed information is afforded on a proposed project to extend the experiment of electric lighting in the streets to four districts, one of which is the District No. 3 of last year. Eight tenders for this work were submitted, with the following general result:

	Tenders ranged from		Cost of gas.
District No. 1	£2,190	to £8,750	£551
" " 2	2,350	to 4,270	363
" " 3	2,479	to 3,800	341
" " 4	2,920	to 4,350	612

Some of the contractors coupled with their tender the request to be allowed to light private premises within the districts, and in one case the company offered to make the charge for lighting (not including installation) 20 per cent. more than the cost of the gas saved. None of the proposals made were of such a character as to justify the Streets Committee in recommending an extension of the experiment, particularly as by the Bill now before Parliament, and the amendments suggested by the Board of Trade, it is proposed to give power to local authorities to supply electricity not only for public but for private use; until this important question has been settled, the Committee deem it unwise to incur further expense in the matter.

It has been decided, however, to continue the lighting of District No. 1 for another year, the Anglo-American (Brush) Company having undertaken the work for £800. An offer was made to Messrs. Siemens to continue the lighting of District No. 2 for twelve months further, but the sum they asked (£3,600) was considered too high, and the Commissioners have returned to gas in this district. We should mention in conclusion that Mr. Haywood speaks very favorably of the Edison incandescence lighting on the the Holborn Viaduct, and promises a special report on this installation, as well as on that in district No. 2, which is being lighted with Weston lamps by the Electric Light and Power Generating Company.—*London Engineering.*

THE HISTORY AND STATISTICS OF AMERICAN WATER-WORKS.

BY J. JAMES R. CROES, M. AM. SOC. C. E.

(*Continued from page* 272.)

CCCLXXI TOMBSTONE.

Tombstone, Arizona, in lat. 33° N. long. 110 W., is a mining town settled about 1878.

There is no water attainable at the site of the town. The first water supply was introduced by a private corporation from Sycamore Springs at the base of the Dragoon mountains, eight miles north of the town and conveyed by wrought-iron pipe to two small tanks 50 ft. above the town. Another supply was introduced by the Tombstone Water, Mill & Land Company from a stream 2¼ miles west of the town, whence it is conveyed to a reservoir of 110,000 gallons capacity on Comstock Hill near the town.

In 1881 and 1882, the Huachuca Water Company constructed works, just completed, taking the supply from the head of Miller's cañon between the two highest peaks of the Huachuca mountains, 25 miles south of the city. A reservoir, 100 by 80 ft. and 22 ft. deep, 1,000 ft. higher than the town, collects the water, and from this it is conveyed 25 miles by a 7-inch wrought-iron pipe down the cañon, across the San Pedro Valley 1,900 ft. lower than the source, and up again to a reservoir excavated in rock 365 ft. above the principal street of the city. It is 90 by 80 ft. and 20 ft. deep, lined with stone masonry and floored with Portland cement concrete. The supply pipe from the Huachuca reservoir receives on its way additional water from a spring in a lateral cañon which is introduced through a 3-inch pipe under 1,800 ft. head, and also from Carr's Cañon, the water from which is led into the main by a 5-inch pipe 4 miles long.

The distribution is by wrought-iron pipes. Two 7-inch pipes lead from the reservoir to the principal streets through which 6-inch pipes are laid, with 3-inch pipes in the cross streets. There are 53 fire hydrants.

The works have cost $500,000. The capacity of daily supply is estimated at 800,000 gallons.

Further information has not been obtained.

TO BE CONTINUED.

CORRECTION.

THE SOMERVILLE, N. J. WATER-WORKS.—In our description of these works last week the daily capacity of the four "multifold" filters was stated to be 1,500,000 gallons. It should have read 500,000 gallons, the beds being 20 inches deep.

CORRESPONDENCE.

"AN IMPROVED LEVEL."

NEW YORK, Aug. 3, 1882.

EDITOR ENGINEERING NEWS:

DEAR SIR: I notice in your valuable number, July 15, a lengthy description of improved Y level, purporting to be patented by W. Gardam & Sons, of this city.

As *their* so-called improvement is a clear infringement on my patent right, which they acknowledge, as to center and seat attachment, tangent screw moving with bar, protection of center from dust, etc., and arrangement for holding telescope in truly horizontal position, I take this opportunity of informing those engaged in the manufacture of engineering instruments, as well as those using them, that I shall institute legal proceedings against the above named and all those unlawfully infringing on my patent right, of which number and date of issue are hereby annexed, and which may save trouble and expense to those engaged in making improvements.

No. of patent, 201,155; date of issue, March 12, 1878.

In justice to the above facts, you will please publish same, and oblige

Very respectfully,

F. E. BRANDIS, 55 Fulton st., New York.

THE WEST SHORE RAILROAD.

The public scarcely realizes the extraordinary degree of energy which the New York & West Shore Railroad is displaying in the pushing of its great enterprise through New York State. Taking into account the extent of the work now under contract, and the extraordinary character of much of it, in the tunneling, excavating and bridging required to complete the road bed at many points, it may safely be said that no work of equal magnitude was ever before pushed as this is now being pushed, either in this country or in the world. It still remains a mystery to the general public where the capital for the undertaking comes from, and it is altogether a mystery what its affiliations are to be when completed. Whatever its source, the capital has thus far been steadily forthcoming, under circumstances which leave little room for doubt that those behind the road not only mean to complete it, but to subsequently own and manage it. Something of the great cost of the undertaking can be imagined from the fact that the right of way for the West Shore road is costing more than was ever paid before in this country for the right of way for an equal distance. The road runs the whole distance through populous and valuable lands, and through the heart of numerous cities and villages. To secure a right of way under such circumstances is a very different undertaking from that entered upon by the projectors of new railroads in the Western country, or by the New York Central road at the time of its construction. That the West Shore road will be the most expensive railway ever constructed over a similar distance may be safely taken for granted. The compensation lies in the fact that immediately upon its completion it will enter upon the fruits of a business, both through and local, already built for its enjoyment—equal, in all probability, to that of any of its long established rivals. Notwithstanding this fact, there are careful students of such problems who express doubt whether such a road can earn enough at prevailing freight rates to make fair returns upon the enormous cost of construction. There can be no question that there is room for more trunk roads than this country now possesses for the movement of Western products to the seaboard. The West Shore road will have its full quota of business without affecting that of other roads. Within ten years the same thing might safely be said regarding two or three other new trunk roads, so rapid is the development of the country. But every year the cost of the right of way for such enterprises increases, and this element promises to prove a bar to the speedy duplication of an enterprise like the West Shore.—*Utica Herald.*

NOTES.

LENGTHS OF RAILS.—The Indianapolis *Journal* is of the impression that a new question among railroad men has sprung up regarding the most profitable and economical length for rails on the track. Up to ten years ago, a rail 16 ft. in length was in general use; then the more prominent lines began laying a 32-ft. length rail. Now, several roads are introducing a rail 60 ft. in length, and as soon as the new mill in Chicago is fairly in operation, rails 120 ft. in length are to be manufactured, and tested on one of the northwestern lines. The argument in favor of long rails is the fact that the chief wear on the rails is at the joints, which become battered usually long before the body of the rail is much worn. Then it is further argued that the wheels under the cars will wear a third longer on a 120-ft. rail, they being more worn in pounding the ends of the rails than in the actual turning of the wheels. It will be noticed, further, that with the lengthening of the rail a heavier rail is taking the place of a lighter one, but few first-class roads now laying a rail lighter than 60 pounds to the yard.

THE ENDURANCE OF WOODEN BRIDGES.

Some interesting literature was presented recently before the London and Middlesex Archæological Society, concerning "Old Fulham Bridge," in which the history of this venerable stucture was reviewed and particularized to show its almost wonderful endurance and longevity, as demonstrating that the superior character of bridges constructed of materials other than wood over the latter, is by no means an established fact, and that much must be accomplished to outwear a strong and well-built bridge of wood. The bridge referred to, which is located at London, between Putney and Fulham, is a timber structure, and the oldest existing bridge over the Thames in the metropolis, though it was erected in the year 1729, to supply an immediate and temporary want until its place could be occupied by a more permanent structure. Instead of being a comparatively ephemeral affair it has survived and done good service all these years, while two ponderous stone bridges over the Thames have become ruins, and have been pupplanted by more modern structures.—*Manufacturer and Builder.*

ENGINEERING NEWS
AND
AMERICAN CONTRACT JOURNAL.

Tribune Building, New York City.

GEO. H. FROST.....EDITOR AND PROPRIETOR.
S. D. V. BURR.....ASSOCIATE EDITOR.

SATURDAY, AUGUST 12, 1882.

EDITORIAL ANNOUNCEMENTS.

Terms of Subscription.—To the United States and Canada, $4 per annum, including postage; all parts of Europe, $5, payable in advance. Remittances at the risk of the subscriber, unless made by registered letter or by draft, check or P. O. order, payable to GEO. H. FROST.

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Articles for Publication in the current number should be received at the office of publication not later than Thursday morning, and advertisements not later than Friday noon.

Correspondence upon subjects which naturally belongs to the province of this journal is solicited.

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NOTICES OF MEETINGS.

AMERICAN INSTITUTE OF MINING ENGINEERS.

COLORADO MEETING.

Programme.

Saturday, Aug. 19—In Denver. A brief preliminary evening meeting, at which the Institute will be received by the citizens of Denver.

Monday, Aug. 21—Visit to Black Hawk and Central, with an evening session at Central City.

Tuesday, Aug. 22—Georgetown. Idaho Springs. Return to Denver in the evening.

Wednesday, Aug. 23—Leadville, going over the South Park Railroad. Evening session.

Thursday, Aug. 24—Excursions to the Leadville mines.

Friday, Aug. 25—Excursions to the Leadville smelting works, reaching Pueblo at night.

Saturday, Aug. 26—Pueblo Iron and Steel Works, and Mather & Geist's Smelting Works. Colorado Springs and Manitou in the evening.

Sunday, Aug. 27—Colorado Springs and Manitou.

Monday, Aug. 28—Return to Denver. Evening reception.

Tuesday, Aug. 29—Argo Smelting Works. Golden and its smelting works. Subscription dinner.

Besides these excursions, facilities will be afforded those who desire to see the iron and coal mines of Colorado. And for those who can extend their visit, an excursion to the San Juan district will be organized.

Arrangements are being made with the railroad companies for reduced rates to members of the Institute and ladies accompanying them. When concluded, a circular will be issued informing members of the expenses from different points to Denver and return. These rates will probably not exceed two-thirds the regular rates, or about $60, plus Pullman car special rates, from New York to Denver and return. Special facilities are courteously offered by the roads in Colorado for the excursions of the Institute.

Persons proposed for membership have the same privileges as members with regard to the meeting and excursions.

As usual at the meetings of the Institute, ladies are expected to be present. Seventy-seven members with forty-three ladies have already signified their intention of being present at the Colorado Meeting, and it is expected that the attendance will greatly exceed these numbers.

The unusual attractions offered by the mining regions of Colorado are increased at this time by those of the Denver Exposition of mining appliances, minerals, etc., and by the unusual facilities offered for examining mines and works, and acquiring information concerning them.

The representatives of several foreign kindred societies are expected to be present.

Members who purpose attending this most interesting meeting should at once write the secretary of the Institute, who has to notify the railroad companies of the number of tickets required, and the names of those entitled to the special rates offered. They are also requested to inform the secretary promptly of their intention to read papers at the meeting.

Prof. W. I. Marshall, who is well known by his lectures on the wonders of the Geyser Country, offers to conduct a party of not less than eight, nor more than twenty-five, through the Yellowstone National Park. This trip would occupy from twenty-six to twenty-nine days from Denver to and through the Park and back to Denver. The greater part of this time would be spent "camping out" in the Park. The expenses of this round trip are estimated at from $275 to $300 for each person. Full information concerning this trip may be obtained from Prof. W. I. Marshall, Fitchburg, Mass.

R. P. ROTHWELL, President,
27 Park Place, New York City.

T. M. DROWN, Secretary,
Easton, Penn.

THE STRIKE of the freight handlers of the railroads leading out of this city, which began eight weeks ago and presented every appearance of being indefinitely prolonged, has suddenly come to an end, the men returning to work at the old prices. They were receiving seventeen cents for each hour's work, and struck for an advance of three cents. The companies immediately filled their places with other men, and it suddenly became known that the rapid handling of freight, with a minimum expenditure of man power, was a science not to be learned in a day. Although the new men were the physical equals of their predecessors, they lacked the "tricks of the trade," and as a consequence a double number was required. It was some time before the business of shipping by rail returned to anything like its old methods, and the consequent delays were both annoying and expensive. During the whole time of the handlers' idleness they have preserved a quiet and gentlemanly demeanor that has done much toward winning the sympathy of the public.

DEATH RATE AT ASPINWALL.—A dispatch to the National Board of Health from Dr. Nelson, formerly a member of the Board of Health at Panama, dated the 28th ult., states that the sickness and death rate at Colon-Aspinwall, are daily increasing. "Fever, as the canal officials call it, sweeps away not only laborers and strangers, but officials of the canal company as well." We quote as follows:

"As a case in point, Mr. Montel, 'sans chef,' breakfasted here on Tuesday last and died last evening (Thursday) of 'malignant fever,' so-called. (Malignant yellow fever fast enough.) The Lady Superior of the hospital there (canal) died last night. To-day the death of the Roman Catholic cure is reported, as well as the sickness with yellow fever of the Superior chief of the canal company, all in Colon, Aspinwall. Colon to-day has a population estimated at 3,500; say there are also 2,500 laborers and canal officers; this is a total of 6,000 people. They are at present dying at the rate of 100 a month—1,200 a year. If it keeps on, in five years the last individual would die. Natives in numbers are dying of fever. The ever increasing filth of the city is ascribed as the cause. New cases of small-pox appear in this city from time to time; deaths also from yellow fever among the unacclimated."

THE OUTLOOK.

During the past few weeks the market reports have shown but little change in prices, and not a brisk demand. Building operations in this city are by no means as extensive as was indicated during the opening of the season, and are mainly confined to the completion of contracts now under way; the new enterprises of such great magnitude which were promised in the spring have failed to show any signs of activity. In other sections of the country, particularly the West, building schemes are abundant, yet it seems to be a noticeable feature that the undertakings taken as a whole are confined to projects which singly do not call for a great outlay of capital; works requiring large expenditures are only found occasionally. As a consequence, the prices of building materials have decreased to their present position, and will probably show but little variation during the remainder of the season. Wages for skilled labor are not so high here, but have increased in the West, owing to the demand and lack of men.

Railroad operations continue with unabated vigor, and it is difficult to find a paper which is not chronicling the stereotyped expression "one mile of track laid each day" on some road. General railroad supplies are selling at fair prices, yet there seems to be a hesitancy, both of the buyer and seller, and inquiries are largely made for deferred delivery, until the future of the market can be more plainly seen. The statements of earnings of new roads and extensions and branches of old ones show, in a majority of cases, a traffic that will ultimately pay. How long this state of affairs will continue it is impossible to state, although, judging from the seemingly inexhaustible financial resources of the roads, the date of a cessation must be placed some distance in the future.

NEW PUBLICATIONS.

JOURNAL OF THE ASSOCIATION OF ENGINEERING SOCIETIES.

We have received No. 8 of the first volume of this journal. The pamphlet opens with a communication addressed to "The Engineers of America," and signed by the Western Society of Engineers, the Boston Society of Civil Engineers, the Engineers' Club of St. Louis and the Civil Engineers' Club of Cleveland. Since last November these societies have been publishing their papers and transactions in common, and in regard to this arrangement state that "with the exception of some delay due to the novelty of the experiment and the inexperience of the management, which is not likely to again occur, the result has been eminently satisfactory." The address then continues:

By this arrangement we have secured valuable results at a moderate cost; but we would ask you, shall this end here?

Why should not the societies at Pittsburgh, Philadelphia and Denver, and the broader associations, namely, the American societies of Civil Engineers and of Mechanical Engineers, and the Institute of Mining Engineers and the Master Mechanics' Association, also publish with us? They could also issue separately if desired, exactly as one gets a hundred copies of his paper issued in pamphlet form in any one of these bodies. Although perhaps no man would care for the whole of any one number issued, yet the result would be a journal without equal in the world, and the engineering profession generally would be largely benefited thereby.

We ask you individually to think of this matter, and if it meets your approbation, see if you cannot help to bring about so desirable a result. There are, of course, difficulties, but experience has shown that there are none which are insuperable. While what we deem a good beginning has been made, and great advantages have been derived, and we believe will continue to be derived from the present arrangement, we fully realize that much more can be accomplished than is now possible, but that it cannot be done without your aid to secure the co-operation of the engineering societies of the land.

The journal contains the following papers: "Notes on Co-ordinate Surveying," by Wm. E. McClintock of the Boston Society: "Experimental Study Comparing the Influence of Expansion in Simple and Compound Engines," read before the Industrial Society of Mulhouse by M. O. Hallauer, and translated by Charles A. Smith of the Engineer's Club of St. Louis; "The Pullman Sewerage," by Benezette Williams of the Western Society. In our issue of June 17 we publish extended extracts from this paper.

In conclusion, the proceedings of the Boston Society, at meetings held May 17 and June 21, and of the Western Society, at the meeting of June 6, are given.

THE AMERICAN INSTITUTE OF MINING ENGINEERS.

We are in receipt of the following papers read at the Harrisburg or Washington meetings: The Binding of Blast Furnaces, by S. H. Chauvenet, C. E.; Late Developments in the Siemens Direct Process, by Geo. W. Maynard; The Gold Fields of the Southern Portion of the Island of San Domingo, by Richard P. Rothwell; and The Mining Work of the United States Geological Survey, by S. F. Emmons.

THE INSTITUTION OF CIVIL ENGINEERS.

The following papers have been received: Hay and Higginson, on Bridges in New Zealand; Slagg, on The Burning of Town-Refuse at Leeds; Johnston, on The New York Elevated Railroads; Boyle, on the Rokugo River Bridge; Mansergh, on the Lancaster Water-Works Extension; Gobert, on Canal Navigation in Belgium; Cundy, on Light Scaffolding; Bender and Gaudard, on Resistance to Wind Pressure; Matheson, on Steel for Structures; and Clerk, on The Theory of the Gas Engine.

KNIGHT'S MECHANICAL DICTIONARY.

Knight's New Mechanical Dictionary. Section I. 240 pp. $2. Boston: Houghton, Mifflin & Co. 1882.

We have been using the original issue of Knight's Mechanical Dictionary for five years, and are always delighted at an opportunity of

praising it. Such a fund of reliable information on mechanical and scientific topics, in such readable shape, is no where else to be found. The present issue is supplementary, and intended to cover the progress in mechanical improvements since the first issue. We find in it the same excellence of arrangement, precision and clearness which render the first volume so attractive: but the illustrations are not of the same order of merit. The publishers have not seen fit to embellish this volume with first-class wood cuts, but have introduced, instead, a mongrel selection of seven hundred and fifty-nine bad, very bad, and execrable illustrations, which, on many pages, disfigure rather than illustrate the text.

PERSONAL.

CORPS OF ENGINEERS.—Lieut. Col. Godfrey Weitzel, corps of engineers, is detailed as a member of the commission advisory to the Board of Harbor Commissioners of the city of Philadelphia, constituted in orders from the Executive Mansion, May 25, 1880, vice Col. John M. Macomb, late of the Corps of Engineers, who was retired from active service June 30, 1882. The following named officers of the Corps of Engineers will report in person, on the dates set opposite to their respective names, to Lieut. Col. Henry L. Abbott, Corps of Engineers at Willett's Point, New York harbor, for duty with the Battalion of Engineers; Second Lieut. Edward Burr, September 30, 1882; Second Lieut. Oscar T. Crosby, September 30, 1882; Second Lieut. Lansing H. Beach, October 21, 1882. Leave of absence for seven days from August 1, 1882, is granted Second Lieut. James C. Bush, 5th Artillery. Leave until November 1, 1882, is granted to Post Chaplain Robert McWatty, U. S. Army.

MAJOR-GENERAL G. K. WARREN, died at Newport, R. I., on the 8th inst. He graduated from the United States Military Academy at West Point in the Class of 1850. He was promoted Brevet Second Lieutenant of Topographical Engineers, July 1, 1850; First Lieutenant, July, 1856, and Principal Assistant Professor of Mathematics, Nov. 3, 1859. On the breaking out of the late war he was, on application of General Duryea, appointed Lieutenant Colonel of the Fifth Regiment Zouaves, and was engaged in the action of Great Bethel, and in the defences of Baltimore, assisting in constructing Fort Federal Hill. On the promotion of General Duryea, he succeeded to the command of the regiment, Aug. 31, 1861, and was promoted Captain of Engineers in the United States Army. He was engaged in the siege of Yorktown, and was placed in command of a brigade, May 24, 1862. He was at the capture of Hanover Court House, and the battle of Gaines' Mill, June 27, 1862, and was engaged in the battles of Malven Hill, July 1, and Manasses, Aug. 30, 1862. He participated, also, in the Maryland campaign, holding the centre of the line at Antietam. He was promoted Brigadier General, Sept. 26, 1862, and Major General of Volunteers, May 3, 1863. He was placed in command of the Fifth corps, March 24, 1864, and was at the siege of Petersburg, June, 18, 1864. He was promoted Major of Corps of Engineers, June 25, 1864; was breveted Brigadier General U. S. A., for gallant and meritorious services in the field during the rebellion, and was engaged in the battle of Five Forks, the last battle of the war, when the unfortunate misunderstanding, which deprived him of his command, took place between Lieutenant General Sheridan and himself. General Warren was the first officer ever assigned from the West Point Military Academy to a volunteer regiment.

DOUBLING ITS LINE TO MANITOBA.—A dispatch says that the St. Paul, Minneapolis & Manitoba Company has a party of surveyors in the field surveying a line from Morris, Manitoba, and Pembina. This new route will run direct from Winnipeg to Pembina, thence south, and will connect with the main line running north from Grand Forks, and now about completed to Hamilton, in Pembina County. The route when completed will give the St. Paul, Minneapolis & Manitoba two direct lines into Winnipeg from St. Paul. Bonuses of $150,000 have been subscribed by citizens along the proposed line.

TESTING AND TESTING MACHINES.

THEODORE COOPER.

The increasing demand for new and more practical information in regard to the strength of our materials of construction, is a sufficient indication that the numerous tests heretofore made, are far from satisfying our wants.

As an effort is now being made to have a more careful and extensive series of experiments made upon our structural material, to at least partially satisfy this demand, it is desirable for all interested in the use of the metals, either as designers, manufacturers or users, to outline beforehand what information is most desired; and to advance such facts as may be of assistance in reaching the desired end in the most direct and economical manner.

Small Specimens.—The great mass of tests heretofore made have been upon test-bars or specimens. Sometimes these specimen bars have been actually cut out of the larger pieces, of which the strength was sought. But frequently they were formed by drawing down the large pieces under rolls or hammers, or, by making special casts of a small size; it was, of course assumed or intended that such specimens would represent relatively the strength of the larger pieces. Too often the only result sought even upon such specimens was the breaking strain. The results and conclusions drawn were contradictory, confusing and unreliable. It is not strange, therefore, that the general opinion in regard to the strength and capabilities of our materials has been full of erroneous conceptions.

When the *test strength* of the same material can be made to vary as much as 50 per cent., by giving the specimens different forms, by different methods of testing, and by variations in the manner of measuring the strains, without considering that too often the specimens were specially selected to advocate particular interests, the value that should be given to the great mass of these experiments is very small. To experiments giving the breaking strain only, omitting all mention of the shape and size of specimen or manner of preparing the specimens, and without reliable data giving the ductility of the material under the breaking strain, the expert would give *no value*.

So much time, material and money have been expended uselessly in making tests of the character above mentioned, it is now generally recognized as desirable that all specimen tests be made upon a uniform standard size and shape, and that not only the breaking strains be recorded, but also the elongation of the specimen over a fixed distance, and the contraction of area at the broken section, as well as all other data in regard to the manner of testing and preparation of the specimens. By thus eliminating the variations due to the different forms and sizes of specimens, we get, by an examination of the breaking strain and ductility, a *comparative* value for the material under examination.

The idea that specimens taken from large masses of material represent relatively the strength of the larger pieces is not now so prevalent as formerly, but still lingers in the minds of too many, even of the engineering profession.

If a forged, cast or rolled piece of iron or steel were subdivided into numerous small specimens, and the strength of each specimen determined, we could not then, unguided by a knowledge of its mode of manufacture, be assured that the strength of the original mass would be as great, relatively, even as the *weakest specimens* cut from it. The individual specimens may be comparatively free from any internal strains, while the original mass may have been near the rupturing point in some section from internal strains due to the method of manufacture.

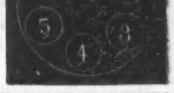
Below I give the results of tests made upon some of the large steel anchor bolts made for the St. Louis bridge, which ruptured while being subjected to the standard working test of 40,000 lbs. per square inch. As the breaking of these bolts was a surprise to those interested, samples were cut from each of them and tested to see if it was the fault of the quality of the material. It will be seen that *all* the samples were from *three* to *eight* times as strong, relatively, as the original bolts.

SOME TESTS OF STEEL ANCHOR BOLTS FOR ST. LOUIS BRIDGE, AND TESTS UPON SAMPLES CUT FROM THE SAME BROKEN BOLTS.

Length of bolt, feet and inches.	Diameter of bolt, inches.	Breaking strain, lbs. per square inch.	Specimens from same bolt, lbs. per square inch
34 ft. 5 in.	5.75	30,000	101,000
			100,000
36 " 1 "	5.75	33,000	130,000
			118,200
31 " 11 "	5.87	26,000	130,000
			122,000
32 " 0 "	5.89	10,400	No. 1, 110,000 } Specimens left as cut from anchor bolts.
			2, 114,500 }
			5, 115,500 }
			2, 78,500 } Specimens annealed after being cut from bolt.
			4, 81,000 }
			6, 92,500 }

This last bolt was an annealed bolt.

The samples 1 to 6 were cut from the broken end and numbered as follows, and every other one annealed.



The above tests were made upon some of the first of these bolts that were forged.

Those made at a later period proved very satisfactory, and stood the standard test of 40,000 lbs. per square inch without any permanent set.

The specimens taken from the successful bolts do not differ in general results from those cut from the defective bolts.

The difference was largely due to greater care in the processes of manufacture.

The testing of every piece of a structure, or a proportion of them, up to a specified limit within the elastic limit, is a very desirable operation as a check upon the mode of manufacture, but unfortunately it takes time and money.

STRENGTH OF LARGE MASSES, OR FULL-SIZED PRACTICAL FORMS.

In general terms the strength of all forms of the metals is dependent upon numerous factors, which may be classified into those due to characteristics of the crude metal, and those due to the work performed upon the crude metal. (The term crude metal being used relatively; for instance, what would be crude metal to the bridge manufacturer would be finished metal to the rolling mill, and what would be crude metal to the rolling-mill would be finished material to the puddler; and the crude material of the puddler would be the finished product of the blast furnace.)

Every kind of work put upon a piece of iron or steel produces changes in the characteristics of the material—whether it be by hot working under rolls or hammers, wire drawing, cold working, stretching in a testing machine to points beyond the elastic limit, annealing, bending, punching, etc.

The work may be beneficial or injurious according to the particular character of the work and dependent upon the purpose to which the finished product is to be applied.

The character of the ingot metal, amount of reduction in the rolls, size of the rolls, number of passes, number and condition of the heats, etc., all influence the characteristics of the finished metal.

In built structures like girders and columns we have not only the variations in the rolled sections from which they are formed, according to the particular rolling mill processes and the kind of iron used by the mill; but we have the additional variations due to the processes of punching, straightening, riveting, etc., in the building of the piece.

In making tests of large masses of metal or of built structures, we are liable from the variations in characteristics of the crude material and in the several processes of manufacture to obtain appar-

ently contradictory results, and to be confused as to any law governing their proportions.

Any tests made upon such masses or built structures, should, as far as is practicable, be accompanied by a detailed history of the processes through which they have passed, and also be accompanied by tests made upon the crude material used in their formation.

Where a series of any kind of structures is to be tested, as beams or columns of varying dimensions, they should all be put through the same processes and be made by the same establishment from one kind of crude material. The law dependent upon their proportions might then be determined with more certainty. Comparison of different series of other material and other manufacturers would then give us a knowledge of the variations due to different crude materials and different processes of manufacture.

Too much stress has heretofore been laid upon the breaking strength of our materials of construction to the neglect of other data of great importance.

In many classes of our structures it is of vastly greater importance to be able to so proportion them that they can be subject to certain repeated and prolonged applications of loadings without breaking, than to know that they will break under a single application of a load we have no intention of applying.

The laws governing the shapes and proportions of any structure, which is to give the best results under a rupturing strain, are entirely different from those governing the proportions and shapes, when the structure is to be subjected to certain limited strains only, especially when these limiting strains are intended to be so restricted that no permanent distortion is to take place in any part or member of the structure.

In one case, the ductility of the material enters as a most important factor; while in the other, it does not occur at all, as the ductility or flow of the metal does not commence until the elastic limit is exceeded, or permanent distortion takes place.

The preference to be given to the two methods must be determined by the special circumstances of each design.

In the excellent report upon iron for chain cables of the U. S. Board to test iron and steel, we find the following remark: "Our experiments have been all so carried out that while we have been able to obtain data both as to the mechanical and physical properties of wrought iron, and as to the effect of different methods of treatment of the raw material, all have been made to contribute their quota toward the establishment of methods by which an iron could be judged correctly, as to its *adaptability for chain cable manufacture. Such points* well established would prove to possess value not only to the manufacturers and purchasers of cable and cable iron, but not less to the manufacturers of iron bridges and other constructions, which, *like the cable*, depend for their value upon their power of *resisting, to the utmost, destroying forces* of various and irregular natures" (italics our own).

The first paragraph of the above quotation has our hearty indorsement, but to the second we must take decided opposition.

Chain cables and bridges are two entirely distinct classes of structures, and must be proportioned and judged by distinctly different properties of the material from which they are made.

The only consideration to be given to the element ductility in structures where the strains are kept within the elastic limit, is the influence it may have upon the processes of manufacture. This is a very important consideration, but, nevertheless, it does not effect the *proportions* of the structure.

Much false doctrine and many erroneous conclusions have been drawn from the indefiniteness of the term "strength of materials," and a reliance upon the breaking strain, as determined by testing under a steadily increasing load up to the rupturing point.

The harm would have been far greater had not the experience of practical men contradicted the conclusions drawn from such tests.

And to such experience is due the credit of the advances made in designing and proportioning the great mass of our structures.

Iron which gave high results in the testing machine, experience proved to be most unsuitable for practical purposes.

Forms which gave high test results were found practically to be weak ones.

The difference in the conclusions was due to the different character of strains to which the material was subjected, under the test and under practical use.

That measured by the testing machine being simply a *statical force*, while in almost every practical application of our materials of construction we must resist dynamic energies.

The question to be solved, therefore, is not the statical resistance of a piece of metal, but what *duty* can it perform under certain circumstances.

To determine the best manner of shaping and proportioning our materials to obtain from them the best duty, it is necessary to experiment with them under such strains as occur in actual practice—strains which vary between wide limits, from a purely statical one to the most violent due to explosive components, some being unvarying in character while others are constantly changing between wide limits.

Could we afford the time and money to make *endurance* tests upon each kind and form of structure, our knowledge of the capabilities of our materials would be vastly increased. It is desirable that sufficient of these endurance tests be made under known circumstances to enable us to determine many doubtful points in regard to the influences affecting the duty that can be obtained from our materials.

On considering the great variety of purposes to which we apply the metals, we find the different structures can be divided, *comparatively*, into two general classes, perishable and permanent structures.

The first class, comprising all those which are limited in their life by their loss of material through use or oxidation and by the deterioration of the metal through the action of the strains upon their peculiar forms—such as boilers, rails, rolling stock, cannon, chain cables, etc. The second class, those which are intended to last an indefinite time, as bridges, roofs, certain classes of machinery, etc. Now, the amount of work that can be performed by any structure up to the rupturing point is proportionate to the breaking strain into the ultimate elongation of the piece; and this is usually considered to be a measure of the ability of the piece to resist dynamic energies. This is probably true within *certain limits of time or velocity.*

The development of the ductility or flow of the metal requires time. If the velocity of the force to be resisted exceeds the velocity of flow of the metal, the bar will rupture without flow. This is shown by the difference in the fracture of even a ductile metal, by slow or sudden strains.

Different metals which give the same rupturing strain and equal ductility under the ordinary testing machine test will show different results when subject to impact and punching tests. If the users of steel plates would experiment upon a decreased velocity in their punching machines, so the metal would have more time to flow, they would probably find the effects of punching much less injurious to the steel. A set of steel plate tests made under the ordinary punch and a set under the slow-moving hand punch would be interesting as illustrating this point.

The amount of work that can be performed by any structure up to the working or elastic limit is entirely independent of the ductility and is proportionate to the working or elastic strain into the elastic elongation due to such strain.

As this work measures the "duty" of our permanent structures, it is very important for us to know to what extent we can depend upon the elasticity of our materials of construction under the varying circumstances to which they are liable. Does the elastic limit vary with different methods of straining the piece? Does the velocity with which the force is aplied, effect the position of the elastic limit? Is there an approximate point considered from the zero of strain which marks the elastic limit, or is it determined by an Elastic Range measured from any initial strain (at which the material may have had time to take on a new state of equilibrium)? For example, if a piece of metal (which would show a limit of elasticity of 20,000 pounds, under the ordinary tests from zero up to 20,000 pounds) were loaded to 10,000 pounds and allowed time to accommodate its molecules to this condition, would it show an elastic limit only up to 20,000, or would it not go to 30,000.

Again would the same metal which would show a limit of 20,000 lbs. under tension or under compression continue perfectly elastic, if the strains were continuously reversed between plus and minus 20,000, making the range of elasticity 40,000? or would the limit then fall down to near + and — 10,000?

From the results of the experiments of Wohler the writer is inclined to the belief in an elastic range to be measured from any initial condition of the metal, rather than a simple elastic limit measured in all cases from the zero of strain.

A complete knowledge of the characteristics of the metals under different kinds of strains within the elastic range, combined with endurance tests upon each class of structure, must be the true basis upon which to design and proportion nearly all our structures.

Upon such a scientific foundation we can hope to so build as to increase the life of all our so-called perishable structures and to remove some of them possibly into the class of permanent structures.

The life or duty of nearly all our perishable structures is much more dependent upon their elastic qualities than their ultimate resistances of strain and extension.

The ability of many parts of machinery to resist the occasional strains to which they are liable from accidental causes, does not determine their life as generally as their ability to meet without permanent change of form the less severe but more constant forces due to their regular work.

The forms given to the rapidly-vibrating connecting rod of the locomotive, the form of a railroad axle, etc., as derived from the endurance tests of actual experience, all tend toward making them more uniformly elastic under the peculiar strains to which they are liable.

The Testing Machine.—When all the erroneous ideas and false conclusions due to the past use of the statical testing machine are considered, it is very questionable if the injury to the art of construction has not far exceeded the benefits.

The greatest advances made in our knowledge of construction have been due rather to the comparatively fine experimental endurance tests that have been made and to the results of the endurance tests of actual experience, than to the information obtained by means of this machine.

In its proper sphere it has an immense field of useful research. This sphere, in the writer's opinion, is the analysing or resolving the elements of the endurance of any structure or material under different classes of strains.

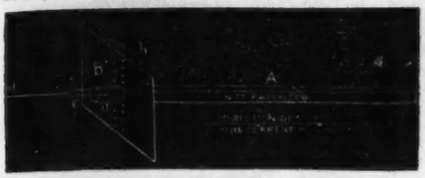
Alone it is no more capable of determining the ability of our materials to resist the dynamic energies to which they are subjected in actual practice than the steel-yards are to measure the possible effect of a steam-hammer or pile-driver.

To interpret the results of endurance tests properly, it is necessary that the elements governing great endurance be analyzed and determined, including not only the statical resistance of the material, but the effect of form, number of applications, duration and the effects of velocity.

We then will be in a better condition to predicate the duty that may be expected from certain classes of material in particular forms.

NEW CURRENT METER.

Besides engineers, owners of sites on mill streams and many others frequently desire to find the velocity of a stream. Few, even of professional men, care to purchase expensive current meters, and few others than professionals could, if they had them, make the experiments and calculations.



The above instrument or contrivance indicates both the pressure and velocity. It is not only the simplest and cheapest, but ought to be more accurate than any other, as *there is no friction of the parts*, to be guessed at or calculated, as in all other current meters or current gauges of which I have any knowledge, and also in all anemometers that I have met (anemometers are sometimes used as current meters); but whether it really *is* more accurate than others I cannot say, never having used anything else except floaters, which I have found *thoroughly unreliable*—if I may so express it.* It can be made by any one, anywhere, at little or no expense. I have used it on two rivers, the Danube and the Rhone, to measure velocities preparatory to placing current motors, and always found the pressure and velocity indicated to be closely corroborated in the power yielded by the motor.

A is of hard wood, 1 in. square and 5 ft. long, and may be in several sections for convenience in packing. *B* is of tin, 6×6 in., but may be of thin wood. The strip *b*, which extends across *B*, and is penetrated by the tenon *a*, is of light dry wood, 1 in. thick and about 2 in. wide (or just wide enough to give sufficient buoyancy to prevent *B* from sinking). Strips of lead (other metal would do) are tacked at the centre of *A*, till it is of about the same specific gravity as water. (Lay it in still water and add all the lead it will bear without sinking.) If no sheet lead is obtainable, flatten out large shot or bullets and tack them on, or drive them into holes bored in the wood. Thus having in the water neither weight nor buoyancy, the current holds *A* horizontal and *A* holds *B* vertical. (*B* being barely submerged, the greatest possible vertical oscillation of *A* would be but 3 in., as 3 in. would bring its rear end to the surface.) *A* being 5 ft. long, a 3 in. oscillation would throw *B* only about 2 deg. from the vertical. *c* is a string loop; *d* a cord, say 5 ft. long, attached to a common spring balance. The balance should be well oiled to prevent rust, and held, say six inches, below the surface; but if, on account of the water not being clear, it has to be held above the surface, then the string should be 20 to 50 ft. long to bring it nearly horizontal, and sufficient lead washers must be slipped on to the tenon, *a*, to keep *B* submerged.

As the pressure of the current is not uniform, the least and greatest pressure within, say three minutes, should be noted and the average taken. The larger the plate *B* the more uniform will be the pressure, but the length and cross section of the vane *A* must be increased proportionately with *B*. Yet I have obtained fair measurements with *an instrument which would go in the vest pocket*, *B* being 1 in. square, and *A* being in sections, with a total length of 10 in. I used the 8 oz. counting-house spring balance.

If one uses a scale or balance whose hand will "set," it may be attached to a pole and measurements taken far below the surface.

Some would suggest to thicken the tail end of *A*, but this would cause an additional "pull" on the cord *d*, which it would be necessary to calculate.

There will be a slight oscillation of the vane which will cause the plate *B* to deviate very slightly from the vertical. This deviation, although too slight to be seen, would cause the indicated pressure to be a trifle less than the real force of the current, were it not for the pressure received by the vane itself, which we have always assumed, when the vane is of the length prescribed, to balance the loss by deviation from the vertical.

The actual pressure on the vane is easily ascertained. Suppose we have a pressure of 36 oz. on the plate *B*—1 oz. to the square inch. Detach the plate and note the pull of *A* alone (using an 8 oz. spring balance). Say it is 1¼ oz. We deduct 1 oz. for pressure received by the front end of *A* (it having 1 square inch area of cross section), which leaves ¼ oz. as the pressure upon *A* resulting from the friction of the water against it.

Some would suppose that if a cord ran from each corner of the plate to the spring balance, or to a common center, the measurements could be taken without *A*, but in such a case the plate does not remain at right angles to the current, but dodges about in all directions. Now if any support be arranged to prevent this bobbing around, there will be friction on the part in contact with that support.

Having the pressure, we get the velocity by Hutton's rule—the pressure in pounds per square foot equals the square of the velocity in feet per second; or, to put it in simpler form, that the uneducated may understand it: Having the number of pounds pressure (say 16 lbs.) against a board or plate 1 ft. square, find what number multiplied by itself would produce 16. That number is 4—the velocity in feet per second; 4 ft. per second equals 240 ft. per minute, equals 14,400 ft. ($2\frac{7}{10}$ miles) per hour. The plate *B* being one fourth of a square foot, 4 lbs. on it would, of course, indicate 16 lbs. per square foot.

S. N. STEWART,
Philadelphia.

*I am aware that many favor floats, and that General Humphreys and Captain Abbot, U. S. Army, relied upon floats in their extensive Mississippi measurements. Just before the battle of Agincourt a messenger said to the Constable of France, "My Lord, the English lie within 1,500 yards of your tents." The Constable replied, "Who measured the ground?" So I would ask Messrs. Humphrey and Abbot and the admirers of their method—who measured the line of march of the float as it moved between two points marked upon shore? A float not only travels faster than the current (sliding down hill constantly, but the hill it slides upon also moves), but the current does not move in a straight line. "There are no straight lines in nature." *A float not only deviates to the right and left*—although it may not seem so seen from shore—but, unless the water is perfectly placid, it moves up and down, over waves or ripples, up hill and down dale.

THE MAGNAGHI FLOATING COMPASS.

The floating compass, invented by Captain Magnaghi, is now in use on board the Duilio, and will probably be generally adopted in the Italian navy. Its main feature, says *Engineering*, is the suspension of the needle in water, to which has been added one tenth its volume of alcohol, contained in a vessel with a perforated bottom, which allows the liquid to rest ultimately on an elastic diaphragm. The addition of the alcohol prevents the water from freezing under low temperatures; and the elastic diaphragm allows it to expand and contract during atmospheric changes, without danger of breaking the glass which covers it, or admitting air. On this liquid the needle floats, enclosed in a hermetically sealed ellipsoidal case, which is very delicately suspended upon a conical brass pivot. The pivot has a sapphire top and a jade point, and the friction is diminished to the utmost possible degree by the most perfect polish. The needle usually consists of six bundles, each made up of five pieces of the best ribbon steel, thoroughly tempered before being magnetized, and separately tested after. These pieces are kept apart by strips of cardboard soaked in oil, and their number can be increased if necessary. Wherever in the apparatus two metal surfaces or edges meet, friction is prevented, and closure secured, by a layer of blotting paper soaked in mineral wax. This is exclusively used for the purpose, because it is insoluble in alcohol; and even the marks and figures in the outside ring are rendered distinct by being filled in with the same substance blackened. All the interior parts of the instrument are silvered, in order to prevent oxidation and galvanic action between the various metals composing it, and to keep the fluid perfectly colorless and transparent. The compass proper (including the floating case with the needles) weighs in the air about 750 grammes; but in the liquid it exercises a pressure of only about 6 grammes on the point of support. The chief advantage claimed for this invention is that the resistance of water being great toward rapid movements and inconsiderable toward slight ones, it leaves the motions of the needle practically free, while shielding it (by its own incompressibility) from all shocks from without. The compasses of the Duilio were not in the least agitated by the discharge of the 100-ton gun, nor by the motion of the screw, although the supports on which they were placed were in such a position as to feel the vibration greatly. They were somewhat disturbed by the rolling and pitching of the vessel; and to meet this difficulty, modifications were made in the shape and arrangement of the different parts, so as to render the floating case thoroughly centrifugal, distribute great portion of the weight round the circumference, and fix the point of suspension very little above the center of gravity. The result of these arrangements is, that when the compass is tilted by the movement of the ship, the needle is so slow to change its position, that before it has again become horizontal the motion is reversed, and the inclination counteracted. The needle is also very little affected by changes in the angle at which the terrestrial magnetic current is inclined to the horizon, which varies in different localities, in consequence of the needles being so much shorter than the diameter of the compass, and being placed too low with regard to the point of suspension. This is proved by the simple test of holding a powerful magnet directly over the north point of the compass, when even this great increase to the vertical force produces only a very slight change in the inclination of the needle. The compass is fitted with a special sextant, in which various improvements have been introduced, to increase the facility and accuracy with which observations can be taken, especially in twilight and cloudy weather.

THE LIVERPOOL OVERHEAD RAILWAY.

The overhead railway along the line of docks at Liverpool, which has just received the sanction of both houses of parliament, is an undertaking of a novel and unique character in railway construction so far as this country is concerned, although in New York a railway on a similar principle has for some time past been in active operation. The Liverpool docks, as is pretty generally known, stretch along the frontage of the river Mersey, to the length of upwards of seven miles, from north to south, and the intended railway will run parallel with the dock, on a high level above the ground line to the entire length. The line, which will be constructed almost entirely on the Mersey dock board's property, will commence near the northern boundary of the board's Liverpool estate, in the adjoining borough of Bootle, and terminate at the Herculaneum dock (which is the extreme south boundary of the dock board's system) in the parish of Toxteth Park. There will thus be railway communication between the two densely populated localities at the extreme north and south ends of Liverpool, as well as stations at different points within those portions of the city of Liverpool itself immediately contiguous to the line of docks. The line will be carried chiefly on piers and columns at an elevation of from fifteen to twenty feet above the roadway, and will pass over several thoroughfares leading from the interior of the city to the river. The railway, which is to be constructed as a double line throughout, is to cost £656,000 for construction only, no purchase of land or compensation being required. Passengers only are to be carried, the railway not being in any sense a goods line.—*Herapath's Railway Journal.*

THE WATER-SOFTENING PROCESS.

The important question of the softening and purifying of hard water in bulk has received a satisfactory solution in the Atkins process, which promises to be of great public service in these respects. This process is a modification of and an improvement upon the old Clark system of softening water, which consisted in adding lime to the water to be softened, and allowing the mixture to stand for 24 hours in large reservoirs or precipitating tanks before it could be used. In the Atkins process, however, the precipitating tanks are dispensed with and the water can be used as it is softened, the process being continuous and no time being required for it to stand and settle. The process essentially consists in chemically purifying the water instead of mechanically as in ordinary filtration. In practice a small jet of lime water is introduced into a portion of the water to be softened, and the two are blended in a mixer, whence they flow into a softening tank into which the bulk of the water is conducted. From this tank the water with the lime in suspension flows into Atkins rotary disk filters, in which the solid particles are all arrested by an ingenious system of cloth-covered disks placed within a tank, and which present a very large area for filtration within a very small compass. The purified and softened water is conducted from the filters to storage reservoirs ready for use. The effect of the lime water is not only to purify and soften the

water in bulk, but to cause any clayey matters that may be held in suspension to coagulate, thus facilitating their removal. The water passes from the outside to the inside of the filters through the cloth-covered disks, the surfaces of which become in time coated with a deposit consisting of carbonate of lime and impurities. These surfaces are quickly cleaned by means of a series of brushes which are brought into contact with the disks. The brushes, which are fixed on a spindle, are rapidly revolved as are also the disks, but in opposite directions, the result being that in a few minutes the filters are cleansed and ready for work again. The system has been successfully applied to private water supplies in several instances, notably at the residence of the Duke of Richmond at Goodwood, and at that of Mr. W. H. Smith, member of Parliament, near Henley. The first application of the system to a public water supply is that of the Henley-on-Thames water-works, which were recently opened. It was introduced there by the engineer to the water company, Mr. Jabez Church, in consequence of the extreme hardness of the water, which is obtained from the chalk, and is normally of about 19° of hardness. After treatment, however, by the Atkins process the hardness is reduced to nearly 4°, which means a beautifully soft water. The apparatus is calculated to soften and purify rather more than 100,000 gallons of water per working day of 10 hours. The softening apparatus was supplied by the Atkins Water-Softening and Purifying Company, of No. 62 Fleet street, London. The system has been tested on the London & Brighton Railway by Mr. Stroudley, the locomotive superintendent, who is having an apparatus put up to soften and purify between 300,000 and 400,000 gallons of water per day for the supply to the boilers at the company's locomotive and carriage works at Brighton. The practical value of the system is, therefore, established as regards the treatment of waters containing carbonate of lime.—*London Times.*

NORTHERN PACIFIC.

LAKE PEN D'OREILLE (I. T.), }
July 26, 1882. }

Very few readers of the *Chronicle* are aware of the rapid progress being made by the builders of the Northern Pacific Railroad on the Pacific slope. So little is said either by telegraph or by the letters of correspondents relative to the Northern Pacific that very few are able to obtain a clear understanding of the railroad situation in the far North. I write this letter at the extreme northern point of Pen d'Oreille lake, about 40 miles from the British line, and 459 miles northeast of Portland, Or., yet I am nearly 50 miles behind the graders who are laying the track eastward. It is difficult to realize how a railroad has been built through these deep gorges and canyons, over bluffs, across miles of lakes, through dense forests, because so little is said about it. The line has been built through Washington Territory, across Idaho, and is now being pushed southeastward as fast as 7,000 men can grade and lay track.

A BEAUTIFUL LAKE.

To better understand the railroad situation in this region, the reader should refer to a map of the northwest. It will be seen that in northern Idaho there are three large lakes, the Cœur d'Alene, the Pen d'Oreille and the Kaniksu, the last being very close to the extreme northern boundary of the United States. Of these three lakes Pen d'Oreille, or, as the people here pronounce it, "Ponduray," is the largest and most beautiful. It is a sheet of water more than sixty miles in length, varying in width from one and a half to four or five miles, and deep enough to float the largest vessel that enters San Francisco Bay. Its surroundings are very beautiful. On all sides the pine-clad mountains loom up. Here and there upon the summits, exposed to the north winds, the snow is seen all the year round, forming a sharp contrast to the inky-black forests which reach from the banks of the lake to the very highest point of the mountains. Tourists rave about the grand scenery of the lower Columbia, the Yosemite, the Grand canyon of the Arkansas, or the gorges of Colorado. Here may be seen wild landscapes, blending all the grandeur and beauty of the above named resorts in one superb whole. It was nearly sunset on the fourth day out from San Francisco when the train suddenly emerged from a long stretch of forest, and crept slowly over a trestle-work one mile and a quarter long, which spans a narrow strait or channel connecting the upper and lower lakes. The scene which presented itself was too beautiful for description. The grandeur of the surroundings must be seen to be fully realized. These immense pine forests of the extreme north are grand and gloomy enough near the coast; but up here, where they extend to the sky, and are blended with lakes, cascades, canyons, and a confused mass of illimitable mountain scenery, they are grand indeed.

SUPPLIES FROM SAN FRANCISCO.

The Northern Pacific has been built around the northern end of Pen d'Oreille lake, the track just elevated enough to be above danger from high water. The bridges seem to be numberless, and trestle work forms a large proportion of the line for nearly twenty miles around the lake. At Pack River, where the stream enters the lake, there is another bridge one mile in length, over which the line passes. Here at Pack River I noticed something worth special mention. Merchandise from San Francisco direct was being unloaded from cars and packed upon the backs of mules, to be taken to British Territory, which is less than fifty miles away. Inquiry developed the fact that this merchandise, consisting of flour, bacon, sugar, coffee, clothing, picks, shovels, powder and sutler's stores was being shipped to the working parties on the Canadian Pacific Railroad. Some of the Packers stated that the Canadian Pacific road is being graded as fast as men can do the work, and that several sections were being constructed eastward and westward simultaneously. This depot of supplies in the mountainous backwoods of Northern Idaho is the nearest and best the Canadian people have found east of the coast.

DIFFICULT RAILROAD WORK.

Near this point the Northern Pacific turns from the lake shore and continues its southeasterly course towards Missoula. It might be well to remark, by way of explanation, that Lake Pen d'Oreille is, in fact, a part of the Columbia River. Clark's Fork of the Columbia enters the lake near the Montana line, and leaves it again near its northern end. The lake is re-enforced by numberless small streams, which empty into it from the adjacent mountains. The work now being done along Clark's Fork of the Columbia is of the heaviest and most difficult character; hence the progress is comparatively slow. To illustrate the character of the work along Clark's Fork of the Columbia in Montana, a cut has been made near Cabinet landing, 800 ft., center height 16 to 28 ft., and averaging 22 ft., and containing more than 24,060 cubic yards of rock, earth and bowlders. This was cut in fifty days by means of giant powder, drills and steam-power.

AMONG THE ROAD-BUILDERS.

From the time one leaves the lake and enters the pass or valley of Clark's fork, one begins to see something of the active work going on at the front. For more than twenty miles workmen are seen digging, chopping, blasting, lifting, cursing and shouting. Trees are crashing down, earth is flying from countless shovels, and huge rocks are being riven and scattered on all sides. As the construction train moves slowly forward, the observer begins to realize some of the difficulties of railroad building in the Northwest. This is about the way it is done: The line having been laid, surveyed and staked, parties of white men, hundreds in a gang, proceed to mow down the forest. The trees are felled with surprising rapidity—it might be said that they are mowed down—and a broad swath, 200 feet wide, is opened up through the forest. The trees are immediately trimmed and cut into lengths and rolled out of the way, when other gangs attack these logs and split them into ties. Now comes another party of white men, who proceed to dig about the roots of the fallen trees; a keg (sometimes two) of powder is placed under the tree stump, a fuse attached, earth thrown about it and tamped down, a light attached to the fuse, and the stump is blown up. The white men pass on, and now come the Chinamen—thousands of them. They proceed under the direction of white bosses, or "herders," as they are called, to level the earth, throw up a roadbed, carry ties from a construction train, or from teams close by, and lay them in place. Other gangs of Chinamen carry steel rails, and white men proceed to lay them and spike them. The supply train slowly moves forward as the track is laid, and other gangs of Chinamen follow on a gravel train and finish the new-laid track. Thus the new railroad is being built toward the Mississippi river at St. Paul.

SCENES AT THE FRONT.

At present only little more than half the distance usually built in clear ground is completed daily. During July twenty-eight miles will be completed. This brings the Northern Pacific (Western Division) to Rock Island, on Clark's fork of the Columbia, 497 miles northeast of Portland, or about 500 miles from the mouth of the Columbia River. On the 1st of August another section of fifty miles will be officially offered for government inspection, and daily passenger trains will begin to run over the newly built section. Near the end of the track may be seen the largest moving city in the world. Never during the present era of railroad building has there been witnessed such a scene as this which now presents itself at the end of the track. Here are at least five thousand persons, all men, except, perhaps, twenty-five, and all bent on making money. There are tents, shanties, caves and "wickyups" of all shapes and sizes. Order or regulation so far as streets are concerned there are none. The valley is too narrow for a compact town site for five thousand inhabitants, hence the tents and shanties are scattered. I counted fifty-one gin-mills, or saloons, a dozen general merchandise tents and shanties and about the same number of boarding tents.

A ROUGH FRONTIER ARMY.

Superintendent of Construction J. L. Hallett reports about 7,700 men employed. Of these about 6,000 are Chinese and 1,700 are white men. Mr. Hallett is prepared to give work to all the white men who desire employment and is preparing to increase the working force at the end of the track to 10,000 men. Think of it! Here is a small army, which is to be fed, kept at work and managed, yet Mr. Hallett succeeds in keeping the scattered thousands all employed, well fed and properly regulated. It is very doubtful whether so large a crowd of rough men, unrestrained by law, were ever so well controlled as these. A wilder or rougher lot of people never assembled at one place on the frontier. There are men of all colors, all nationalities, and refugees from every penal colony in the world. The Chinese are mostly newly imported coolies. They live in tents furnished by the company, and live in gangs of from 50 to 100 under a white herder, who receives from $75 to $90 per month for his services. A more thankless or difficult task can scarcely be conceived of than this of the "coolie herder." He is expected to keep his Chinamen at work; if he fails he is removed by the Superintendent. He finds it impossible to urge or hurry his Mongolian charges. They dig, talk, chatter, laugh and loaf. There is no hurry about a Chinese laborer. He just keeps moving—that's all. When a live, active white man is placed in charge of a gang he attempts to hurry the Mongolians. They usually stand this crowding or hurrying business one day. Next day the gang strikes work. The Superintendent or section boss is sent for, who asks: "What's the matter, boys; why don't you go to work?"

Then the spokesman of the gang meekly and smilingly replies: "Boss no good; we no sabbee boss; we no sabbee boss."

That settles it. A new boss is substituted before the coolies will "sabbee" enough to go to work. Hence, it can be seen who is boss at this neck of woods. Chinamen are hard to get, and they have to be handled gently.

A FUTURE MOUNTAIN METROPOLIS.

Thirty-five miles east of the present end of the track is Thompson's Falls, to which point the road will be completed early in September, leaving just 100 miles to build to Missoula, M. T., the future big town in the North. The graders and working parties are now pushing on ahead of the track and scattering themselves along where heavy cuts are to be made, but as these are very few beyond Rock Island progress will be much more rapid than heretofore. East of Missoula a division of the road has been let out by contract to the Mormons, who are now at work several hundred strong building both ways east and west. Yesterday, while at Sandy Point, near the head of the lake, I witnessed the launching of a handsome little side-wheel steamer to be called the Missoula. This boat is intended to run on Clark's fork of the Columbia between the end of the track at Rock Island and Thompson's Falls, carrying freight, railroad stores, etc. It is the property of Captain David McKinney, an old locomotive engineer from California. The boat is 42 feet long and is light enough to be hauled around the falls and relaunched on the river when the road reaches the present head of navigation.

WORK THAT HAS BEEN DONE.

To give some intelligible idea of the railroad situation in the North, I will repeat the statement made to me the other day by John Muir, Superintendent of Traffic on the Northern Pacific Railroad. Completed between St. Paul, Minn., and Forsyth, M. T., 816 miles; completed between Portland and Rock Island, M. T., 497 miles; complete boat and railroad connection to Thompson's Falls, 438 miles east of Portland. On Aug. 1 a daily line of four-horse stages will commence running between the end of the track and Missoula, where connection will be made with two lines of Gilmer, Salisbury & Co.'s stages for the end of the Utah Northern Railroad, 130 miles south, and to the Bozeman division of the Northern Pacific, via Helena, at Forsyth station. There is now a gap of 624 miles to build, over an open country, and this gap is being rapidly closed up at the rate of nearly four miles a day, as men are working at both ends, and in the center both ways from near Missoula. The present time from St Paul, Minn., to Helena, is four and a half days. On the first of October of this year the passengor time between Chicago and Portland will be eight days, or a little less than the present traveling time between the two cities via San Francisco. The entire line from Chicago via St. Paul, Helena, Pen d'Oreille, Portland to Seattle will be completed early in 1883. This line will traverse some of the most attractive sections of the American continent, including the Lake Park region of Minnesota, the wheat belt of Dakota, Pyramid Park, Red River valley, the

great National Park of the Yellowstone, the Flathead Indian reservation, the Pen d'Oreille lake region and the Columbia River, via the Cascades and the Dalles.

INDUCEMENT TO TOURISTS.

At present the country in the immediate vicinity of Pen d'Oreille Lake is unsettled, its only inhabitants being a tribe of miserable Indians, who live by fishing and hunting, and a few people scattered along the railroad. These mountains are densely covered with valuable timber, including pine, fir and cedar. The cedar is very large, and will prove very valuable. A marble vein or ledge has recently been discovered near here, said to be equal to Italian marble. It is from twelve to twenty feet thick. The locator of the claim sold the marble vein for $10,000 last week. It is said that good indications of gold and silver have been seen in the adjacent mountains, and prospectors are out looking for mines. Elk and deer are plenty, and as for trout, the lakes and rivers are alive with them. To the pleasure-seeker, the tourist and the lover of the grand, the curious and the beautiful in Nature, this region about Pen d'Oreille Lake and Clark's Fork of the Columbia offers the greatest attractions. It is a five-days' journey from San Francisco by steamer and railroad, and the trip is a continual panorama. Bidding a reluctant farewell to the beautiful Pen d'Oreille, I start for Palouse country in Eastern Washington.—*San Francisco Chronicle.* W.

SUBWAYS AND LONDON STREETS.

In the growth of a city such as London the accruing evils of overcrowding its streets fail to attract the attention and consideration they deserve. To meet the increasing wants for shops, warehouses and dwellings, additional height of the buildings is provided, but the main and indispensable arteries of communication by which their comfortable occupancy can alone be secured remains neglected. The several and fluctuating widths of the Poultry, Cheapside, Ludgate Hill, Fleet street and the Strand may have been sufficiently commodious to meet the wants of a London population fifty years ago, but the most careless passer-by of to-day must be conscious that the constantly-recurring and almost chronic "blocks" are not creditable to our modern local government's intelligence. The dangers of the streets are too well known and their painful records too conspicuous to afford any excuse for so persistently neglecting or disregarding their constant recurrence. During some hours of the day a walk from the Mansion House to Charing Cross will prove to the most sceptical observer that other than existing provisions must be made to control and render comfortable such a traffic as that which prevails between the limits we have named. The crowded pavements and the no less over-burdened carriage-way proclaim the fact beyond doubt or cavil, that these lines of streets are incompetent to perform their proper functions, so as to secure safety to the crowds by which they are used.

Notwithstanding the inconveniences and dangers we have referred to, there is much indeed to be thankful for when we consider the onerous and complicated duties thrust upon the streets above and below their surfaces. Underneath, in positions and under such conditions which we had better not too minutely examine, there are innumerable pipes of earthenware, iron, and lead, all huddled in confusing entanglement. A more precise knowledge of what is below it is as well that the confiding householder should never attempt to gain. The telegraph wires, and in some localities the exhaust tubes used by the Post Office for the dispatch of light packages, are added to the long-accumulating deposits made by water and gas companies' pipes during many years. If, therefore, we feel, with good reasons, surprise at the confusion prevailing on the surface, we are the more astonished when an opportunity offers enabling us to examine the dangers lurking beneath. Danger, indeed, lurks there in no stinted form, as more than one unfortunate gas explosion has fully demonstrated.

Besides the danger from gas (seweral and illuminating), there are the decaying pipes, saturating from their state of leakness the soil in which they are imbedded, and thus storing up magazines of future plague-germs and other disease and death-dealing producers.

The three great necessities of life—water, light, and facile disposal of household wants—are secured in such a way as to reflect but little credit on our vaunted civilization and sanitary knowledge. A fire or a gas explosion, or a congested sewer, soon displays the shortcomings and dangers of some of the most crowded London thoroughfares. Yet under the pressure of any unusual strain on the water or gas companies' supplies, a break-down is too common, affording ample proof that London, with its boastful boards and vestries, is much behind in practical efficiency many a third-rate town in less favored districts of the British Empire. Many causes now operate to prevent that unity and compactness of interests which, under any circumstances, is so essential to good and efficient local government; but perhaps the most dangerous and unmanageable ingredients in this question are the vested interests of the gas and water companies. These peculiarly-privileged bodies, endowed with great and almost plenary powers, acquired under the authority of special legislation, usurp in the most reckless manner powers which it was never contemplated they should be permitted to enjoy. The most aggressive acts are committed in furtherance of the aggrandizing policy of these rapacious companies, who disregard all complaints and seem to delight in the knowledge that the great population of London is helplessly enthralled in their binding fetters of monopoly. Rich and poor are alike subject to their rapacity, and no modern parallel can be found to compare with the existing state of gas and water supply in the greatest city of this or any other time. A persistent and well-considered extravagance in needless works enables these giant companies to maintain a defiant position, proof against public feeling or state interference.

Practically, under such circumstances, the water and gas companies and their officials and workmen are lords paramount over the streets of London, interfering in their selfishness with any scheme of subways for the more safe and convenient reception of gas mains and water pipes. Early legislation will, we trust, change such a condition of things, and place in the hands of the public the gas, water and other supplies, when no obstacle would then exist to alter the scheme of indiscriminate pipe-laying as now carried on regardless of the inconveniences and dangers it occasions.

With a perfect knowledge before us of the causes which impede traffic, there can be no question of the desirability of immediate recourse to ample and well-conceived subways for accommodating all apparatus required for the supply of water, gas, and other necessary wants. We have already some moderate examples of subways in several of the new streets constructed by the Metropolitan Board of Works; but by some unpardonable legislative hitch when that self-asserting body was being clothed in its powers, full as they were at the time considered, it was found that the great monopolies of water and gas production and supply could not be compelled to use them. The Metropolitan Board constructed sewers and subways, but "gas and water" clung to their legal powers, and insisted upon disturbing the traffic by a maintenance of the right to lay down and deal with their pipes on the surface as hitherto.

Can there be for one moment any doubt in an intelligent mind that to continue longer apathetic on this most vital question would be to court and encourage a danger becoming daily more imminent? If there was any immediate prospect of a check to the prosperity of London, and therefore some chance of reducing the numbers of its population, then there might be a shadow of excuse for neglecting a matter of such paramount importance as the sensible government and control of its streets and thoroughfares.

Subways for London, more especially in its densely-populated centres and busiest streets, need not be constructed in the exact line of traffic, but take the most convenient routes competent to meet the present and prospective wants of the district they traverse. To construct a subway along the Strand would involve an outlay, measured not so much by the simple constructive character of the work itself, but by consequential damage to trade during progress of the works. In such direction also the dimensions of a subway would be limited to the narrow confines of such a thoroughfare, and quite inadequate to meet the wants of so crowded a district. A much more comprehensive scheme of subways must be contrived to meet not only existing wants, but provide against all coming improvements of whatever kind.

One great advantage which a substantial subway would secure, would be a good and sound foundation on which to build a double roadway. Of whatever materials carriage and footways are now composed, much of their inefficiency and costliness is due to the absence of a thoroughly reliable foundation. The constant reparation and relaying of London's busiest streets is consequent on the inability of the made ground or concrete to resist the shocks and concussions of the heavy, quick traffic passing over it. A roadway, well constructed and of the right sort of materials, would not be so troublesome or costly to repair, for, owing to the permanent character of the walls of the subway, the wearing or surface parts only would require renewal from time to time.

A well-devised scheme of substantial subways would be a costly matter, no doubt, but they would reduce much expense and inconvenience which is, under existing circumstances, unavoidable. It would obviate the necessity of opening up a street and stopping its traffic to make repairs to or re-lay a gas or water pipe, while it would also secure ready access to sewer pipes, and control with greater efficiency their dangers and shortcomings. In cases of fire there would be perhaps the greatest advantage secured, for while having at ready and instant command a supply of water, all the troublesome and confusing crowding consequent upon fires would not interfere with the firemen's duties. It would be desirable, of course, to inaugurate with a good system of subways a competent staff of men to regulate and keep under intelligent control all matters connected therewith, as well as to manage the necessary repairs and examinations. In all weathers the pipes and their contents in the subway would remain proof against the fluctuating influences of heat and cold, securing during extremes of temperature a reliable dependence on the various supplies which they are designed to distribute.

Such a subway scheme would indeed be a leviathan undertaking, but there can be no doubt that it would eventually pay, not only in a financial sense, but in an increased safety from many now almost uncontrollable dangers. To estimate fairly the saving which subways would secure, all and every outlay at present incurred by gas and water companies, vestries and other authorities, in repairs and changes of pipes and roadways must be taken into account. A check would be given to the monstrous expedients of the privileged companies to keep their income under by senseless works, so as to hold at arm's length all Government interference. Many a thousand pounds are thus squandered in needless repairs, so as to give an appearance of vigilant attention to the public wants, and at the same time secure for some favor a goodly income in making the necessary reparations to disjointed pavements and dislocated roadways.

But, alas! on reflection such a scheme as that which we have briefly outlined may be regarded under existing circumstances as the dream of a visionary, for there exists no authority competent to carry it out. The "City" fathers, the Metropolitan Board fashionables, and the vestries and suburban authorities, must be first welded into a homogeneous mass of efficiency before any such dream can be realized. The City and Metropolitan Board notables cannot be too soon restrained in their vagaries, so as to save the Thames from eventual *enshoalment* and the low-lying lands and houses on its banks from perennial flooding.—*London Architect.*

A GALVANOMETER FOR ELECTRIC LIGHT CURRENTS.

At a recent meeting of the Society of Telegraph Engineers and of Electricians, England, a paper was read on a new galvanometer for measuring the most powerful electric-light currents. The action of the instruments is based on the *nil* method of testing—that is to say, reducing the deflection on the scale to *nil* by means of adjustments. The galvanometer consists of an astatic needle placed within two independent circuits, one a coil of long, fine wire, and the other a coil of short and very thick wire, which, in fact, is a stout hoop of brass in some forms of the apparatus. Through the short, thick coil, the electric lighting current to be measured is passed, and through the long, fine coil is passed the current from a single-standard Daniel cell. Resistance is included in the latter circuit until the two currents balance each other by differential action on the needle, and the deflection of the latter is reduced to *nil*. Then by means of a constant or multiplier found for the instrument in question by experiment, the strength of the powerful current in ampères can be obtained.

GENERAL INTELLIGENCE.

☞ *We solicit and are always pleased to publish in these columns any items of interest that may be furnished us.*

GAS AND WATER.

THE PULSOMETER.—The success of the "New Pulsometer Steam Pump," arranged with boiler on small boats, built especially for the purpose of pumping out coal boats and barges, wrecking purposes, washing coal, putting out fires, filling boilers after cleaning, etc., by Messrs. Crowthers, Musgrave & Co., Eli Leonard & Son, O'Neal & Co., James McCleary and others on the Monongahela River has caused a demand for such boats. Messrs. Crowthers, Musgrave & Co. write that they can propell their boat four miles up stream and back in an hour by having the "new pulsometer" arranged to draw the water in at the bow, and forcing it out at the stern. Messrs. Gray, Shook & Co., 46 Water street, Pittsburg, Pa., agents for the "Pulsometer Steam Pump Co.," have lately built several of these boats to meet the demand, one of which has been purchased by Mr. James Sweeney, of New Orleans and sent South.

A SAN FRANCISCO GAS CONTRACT.—At its last session the Board of Supervisors made a new contract with the old gas company, binding the city to take all its gas from that concern for two years. Under this contract the rates are reduced so as to effect an annual saving to the city of about $45,000. This is an important point gained after a long controversy. The gas company, finding that it could not maintain its old fifteen years and five years' contracts, is glad to accept a two years' contract. Knowing that its rates were altogether too high, it re-

luctantly, and after a long fight in and out of the courts, yields to a reduction. Heretofore the cost per lamp has been about $50 per year. The reduction, as we understand it, is about $7 per lamp per year. This leaves the price at about $43 per year per lamp. In New York, the contract price for 1880 was $15 per lamp for the year of 4,000 hours. In 1881, the price was $17. A few of the lamps on the outskirts were a little higher, so as to raise the general average for the whole city to about $19. Between this and the price we are to pay under the new contract there is a margin of $24. We are to pay more than twice as much, and yet we are to get light for 2,360 hours instead of 4,000 as furnished in New York. Official reports show that gas costs no more here than in New York.—*Chronicle.*

PURIFICATION OF MISSISSPPI WATER.—By a circular recently received we learn that the New Orleans Water-Works Company are prepared to enter into negotiations with parties who are able to solve the problem of thoroughly removing from the Mississippi water all the sediment contained therein, so as to render it fit to drink. The officers of the company believe that some apparatus can be found that will filter the water at the suction pump before entering into the pipe. For any such device they say the company can afford to pay a liberal sum of money. All correspondence should be addressed to E. A. Ducros, No. 60 Carondelet street, New Orleans, La.—*Exchange.*

THE CONSUMPTION OF WATER IN BROOKLYN on Tuesday last was 37,582,148 gallons, which is 2,000,000 gallons more than was consumed on the corresponding day of last year. The storage reservoir has run down from 10 to 9 ft. since Monday. At the meeting of the Board of Aldermen last week Mayor Low called the attention of that body to the advisability of increasing the water supply, and its committee on Water and Drainage was directed to co-operate with him in the matter.

AN ILLINOIS OIL WELL.—The gas from the oil well at Litchfield was tested the other night, and found to be excellent for illuminating purposes. The test was made by conducting the gas through a 4-in. pipe to some distance from the derrick, and when lighted the flame shot up to the height of at least 50 ft., burning with exceeding brilliancy.

INCREASED WATER SUPPLY.—To provide an increased water supply for Springfield, Ill., it is proposed to sink a large well in the bottom of the Sangamon, which is relied on to furnish the city a supply of pure and wholesome water. It is the intention to sink such a well during the season.

THE artesian well at White Plains, Nev., is nearly four hundred feet deep. At forty feet depth the borders cut through a stratum of cement about four inches thick, and came to water that was very salt. Next they came to a deep bed of quicksand. Below it was gravel, and below that was a lava formation which has just given place to a bluish rock.

TOMBSBORO', Ga., has an artesian well 500 feet in depth, with a steady flow of fifteen gallons of water a minute.

ELECTRICITY.

ELECTRIC TRACTION ENGINE.—Experiments at a cost of $36,000 are being made at Berne with a view to traction through the St. Gothard tunnel by means of electricity.

LIGHTED BY ELECTRICITY.—Last week the Brush Electric Light Company obtained a five years' contract for illuminating the cities of Rock Island, Ill., and Fond du Lac, Wis., and will start their tower system within three months at these places.

THE SWAN INCANDESCENT ELECTRIC LIGHT CO., of Boston, are setting a 60 horse-power Babcock & Wilcox boiler with the Jarvis furnace at their new workshop on Hampden street. They will use screenings for fuel.

TELEPHONE CONNECTION.—CLINTON, Iowa, Aug. 6.—Telephone connection was established yesterday between this county and Davenport, which unites the exchanges of Clinton, Lyons, Camanche, De Witt, Davenport, Muscatine, Iowa, and Albany, Fulton, Morrison, Sterling, Rock Island, Moline, Genesee, and other Illinois points. The longest distance is between Sterling and Muscatine, 105 miles.

PETOSKEY, Ind., expects to have electric lights.

THE new electric light system will be in operation in Rock Island, Ill., about the 1st of October.

MESSRS. SIEMENS & HALSKE, the well known electricians of Berlin, Germany, have recently built a factory in St. Petersburgh, Russia, for the manufacture of cables and other matters connected with electricity. They expect to be able, in this factory, to prepare some 2,000 miles of submarine cable every year, and the recent opening of the works was made the occasion of much congratulation. The erection of the factory marks only one of the periods in the steady improvement in Russian industries, and will undoubtedly render the country independent in telegraphic appliances.

THE WHEELING (W. VA.), ELECTRIC COMPANY is about ready for active operations. Their capacity at present is only for twenty lights, the rate charged for each light per night being seventy-five cents, including the putting in of the fixtures and all the attention required to keep them in order. Each light is equal to 2,000 candles.

RIVERS AND HARBORS.

THE POTOMAC AT ALEXANDRIA.—The work of improvement along the river front still continues, and more dredging has already been done this year than during the ten years previous. It is thought by some that the filling up of the Washington flats, by narrowing the water way of the river and thus making a quick flow through the narrowed channel in times of flood, will deposit the mud which is brought down by the floods in the wider portions of the river where the water way widens and the current becomes less swift. This, it is said, will have a tendency to injure the harbor of Alexandria. It seems probable, however, that the banks which form the mouth of narrow channels emptying into wider ones will form higher up the river, and no injury result to the harbor of this town.

DREDGING IN THE GULF STREAM.—HAMILTON, Bermuda, Aug. 2.—The Governor, attended by Mr. Hussy, A. D. C., and accompanied by the Hon. Mr. Boyle, Colonial Secretary, visited the United States Coast and Geodetic Survey steamer Blake, Commander J. R. Bartlett, U. S. N., on the 27th ult. previous to her leaving this port for Cape Hatteras. The Blake is on a voyage from New York down the Gulf Stream for the purpose of dredging and sounding in those waters. She is fitted with all modern appliances and has many improvements on the Challenger. She carries a Brush dynamo machine, which gives two side lamps of 2,000 candle-power each, and under these powerful lights work can be carried on at all hours of the night. The engines of the vessel are wonderfully compact and consume the small amount of four tons daily, though the average rate of speed is nine knots an hour. As the Blake carries over 160 tons of coal she can remain away from port with this consumption for six weeks. Her sounding apparatus is as near perfection as modern science can make it. Piano wire is used, which being wound on a patent wheel and sunk by an ingenious contrivance of weighting, enables a depth of three miles to be attained. Commander Bartlett in testing the Gulf Stream finds a bottom of ooze or mud in most places and the flow of heated water continuing to the lowest depth. Sixteen-strand wire cabling is used for the deep-sea dredging, and the dredger itself is so contrived that when the hauling in takes place the net is closely shut, and the various specimens are safely retained. The Blake has eight officers and thirty-eight men.

RAILROADS.

RAILWAY SHOPS.—The St. Paul, Minneapolis & Manitoba Railway Company has at last decided to locate its railroad and repair shops at Barnesville, Minn., which will be the headquarters of the northern division. The shops will be the largest west of St. Paul.

THE new branch which the St. Louis, Iron Mountain & Southern Railway Company proposes to construct in Arkansas is to run from Beebe, White County, in a generally westerly course to Fort Smith, on the line of the Indian Territory, and will be 160 miles long. The country through which it will run is unsurpassed for fertility of soil. The road will cross the Little Rock & Fort Smith Railway at Conway, Faulkner County; thence southwest to the Arkansas River, and after crossing to the south side, will run up the Valley of the Fourche La Fane River through Perry County and into Yell County; thence northwest to the Petit Jean River, up that stream and tributaries to the Sebastian County line; thence across the Voche Grasse River and Massard Creek to Fort Smith. The route is remarkably good for the road, the heaviest piece of work being a bridge across the Arkansas.

WINNIPEG, Me., Aug. 6.—The work of extending the Canada Pacific Railway from Prince Arthur's Landing to Nepigon, north of Lake Superior, is to commence immediately. The survey of the road is complete from Winnipeg to the Rockies.

WORK BEGUN ON THE KILLBUCK VALLEY ROAD.—WOOSTER, O., Aug. 7.—Work was commenced on the Killbuck Valley road from Wooster to the New York, Pennsylvania & Ohio road, near Burbank, to-day. Engineer J. F. Wallace arrived last week, and started out with his surveying corps this morning. The required amount of stock is about all subscribed, and the directors propose to push the work and have the road-bed built from Wooster to Burbank before the coming winter sets in. Bids for the construction are advertised for, and the work will be let on August 24. Bidders are notified that the plans and specifications of the road will be ready for inspection on and after August 20.

EXTENSIONS OF THE CHICAGO & NORTHWESTERN.—Three lines are in process of construction as extensions of the system. The longest of these, the Escanaba and Superior line, is ironed for twenty-four miles, and with the additional laying of twelve miles of track the extension will be complete. The other two branches, one known as the Crystal Falls and the other as the Iron River, are shorter. The former is about completed, and the latter in condition for track laying. These extensions were included in the projected construction for 1881.

BRISK DEMAND FOR RAILS.—An officer of the Milwaukee, Lake Shore & Western road states that recently the company tried to negotiate a purchase of three thousand tons of steel rails from the Chicago steel mills. They were told that the order could not be filled before next fall; as the demand was greatly in excess of the capacity to supply. The company has closed a contract with the Joliet works. Construction of track on the company's extension in Wisconsin is progressing with dispatch.

INCREASE OF STOCK.—The stockholders of the Texas & New Orleans Railroad Company will meet at Houston, Tex., on the 15th inst. to increase the capital stock for extension of a branch line from Woodville, Tyler County, at the rate of $25,000 per mile. The construction of this branch will give Marshall direct communication with Sabine Pass.

THE LITTLE ROCK, MISSISSIPPI RIVER & TEXAS RAILWAY opened a ten-mile extension from Monticello to Warren.

AN INDIAN RAILROAD SURVEY.—The survey of the proposed railroad from Saginaw to Durand, via Flushing, is in progress.

A NEW ROAD.—BOURBON, Ind., Aug. 4.—Col. John Lee, President of the Michigan, Indiana & St. Louis Railroad, reports from New York that the contract for the constructing, building and equipping of said road was closed last Saturday with a syndicate of New York capitalists, who will begin operations about Sept. 1. The road will be a continuous line from Detroit, via Sturgis, Mich., and Danville, Ill., to St. Louis, and will pass about four miles west of this place. Local subsidies all along the line have been voted, except at this place.

THE JOLIET, ROCKFORD & NORTHERN.—The grading and bridge-building on the Joliet, Rockford & Northern Railroad, between Sheridan and Paw Paw, is expected to be done by Sept. 1. Then the iron will be put down and the road ballasted in thirty days, so as to be ready for the winter's coal trade.

CANADA ATLANTIC.—A meeting of the Board of Directors of the Canada Atlantic Railroad was held at Ottawa Friday of last week. A resolution was passed authorizing a special general meeting of the shareholders to be held on the 29th of August, to consider and determine upon the issue of the first mortgage bonds to the extent of $15,000 a mile, the leasing in perpetuity of the Province Line Railway in the State of Vermont, and the issue of preference stock. The President in his report stated that the road is constructed and ballasted to within one-half mile of the Rideau River and the Rideau Canal, and will be fully completed within three or four days. The road is now graded to Ottawa, and the ties will be laid on this portion at once, and the ballasting of the whole line to Ottawa will be completed next week.

PROSPECT OF NEW LINES FROM THE ATLANTIC TO THE PACIFIC.—DENVER, Aug. 1.—The *Tribune* notices a rumor that the Chicago, Burlington & Quincy Railroad Company, which now has direct connection with this city, contemplates the construction of a wide-gauge road westward from here up Chicago creek, following a direct route to the Pacific, and which will lessen the time from ocean to ocean thirty six hours. Surveying has been done through the town and up Chicago creek, but the surveyors are profoundly reticent when questioned as to the object of the survey.

THE Ouachita Division of the Little Rock, Mississippi & Texas Railroad has been opened for business to Warron, Bradley County. Regular freight and passenger trains were put on on Monday, and the road is to be completed to Texarkana.

BURLINGTON & OHIO.—The contract for laying ties and track has been let to Albert Michelson, representing the Moore Railway Construction Company, of Chicago. The grading between Carlinville and Gillespie is about to be let. It is expected to have trains running on part of the line within ninety days.

THE Kingston and Pembroke Railway Company have commenced to lay steel rails on their road. The whole road will be laid with steel rails by the time the junction with the Canada Central is effected.

CITY OF MEXICO, Aug. 10.—The Tehuantepec Railroad Company having forfeited its charter, the Mexican government has resolved to complete the road as soon as possible. The company will be paid for the work done and the material on hand. The work will be continued under the charge of Gen. Porfiro Diaz, as Governor of Oaxaca. Delfino Sanchez, ex-Superintendent of the Morelas Railroad, has been appointed Purchasing Agent. He will soon start for the United States to buy rails and rolling stock. The Toluca Division of the Mexican National Railway, extending from the City of Mexico to the city of Toluca, was to-day approved by the Government, and the road is opened to public traffic.

BUILDING.

NEW ELEVATOR—The excavation for the new mammoth elevator in the lower part of Peoria, Ill., has been completed, and material has already begun to arrive for the building. There will be a force of 200 men employed for a number of months in its construction.

PRIZE PLANS FOR SHOOL-HOUSES.—A commuication was received from Mayor Low at the August meeting of the Brooklyn Board of Education, offering prizes for the best plans for school-houses. The offer included $250 for the best plan of a school-house to cost $15,000; $200 for the best plan of one to cost $20,000, and $150 for the best plan of one to cost $25,000. These prizes are open to competition on the part of architects, and they will be awarded in accordance with the decisions of a committee appointed by the President of the Board, the Chairman of the School-house Committee, the Superintendent of Public Instruction, and the Commissioner of Buildings. The Mayor's offer was accepted.

COURT-HOUSE.—Work on the court-house at Fond du Lac, Wis., has been stopped for awhile on account of the supply of bricks giving out.

BUILDING IN QUINCY, ILL.—Considerable building is going on in different parts of the city of Quincy, and the residences which are being erected are all nice ones.

AUSTIN, Texas, is to have a $250,000 hotel.

TAKIS, Atchison Co., Mo., is to have a court-house built of brick, two stories high, 90 feet square, to cost $30,000.

NEW car shops are to be erected at Stony Island, Ill., near Chicago, for the New York, Chicago & St. Louis railroad.

BRIDGES.

A NEW BRIDGE OVER THE ST. LAWRENCE.—The building of the new bridge over the St. Lawrence above Montreal, at Lachine, which is now projected, will open a new era in the railroad intercourse of Canada and the States. All the roads now entering Montreal from this country pass over Victoria Bridge, and pay toll to the Grand Trunk Railroad. It is intended to afford the use of this bridge to all roads which ask for it. This bridge is to be a double-track truss, costing about $2,000,000, and being opposite the Lachine Canal does not interfere with the shipping on the river. The present monopoly of the Grand Trunk over the Victoria Bridge has been exercised with great severity toward other roads at times, a toll of $5 a car each way for passenger cars being the frequent charge.

MOVING A BRIDGE.—A bridge built near Fond du Lac for the Milwaukee and Lake Winnebago railroad is being uncapped and moved over about nine feet. The bridge is 192 feet long, and was built nine feet out of the way of the survey for the track.